



## TECHNICAL MEMORANDUM

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**DATE:** March 30, 2026 **PROJECT #:** 9100

**TO:** Salinas Valley Basin Groundwater Sustainability Agency

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**REVIEWER:** Colin Kikuchi, Ph.D., Abby Ostovar, Ph.D., and Staffan Schorr

**PROJECT:** Round 2 Sustainable Groundwater Management Implementation Grant for the Salinas Valley

**SUBJECT:** Climate Change Scenario Development and Implementation in the Salinas Valley Operation Model

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### INTRODUCTION

In support of the Periodic Evaluation for the Salinas Valley Basin Groundwater Sustainability Agency (SVBGSA), Montgomery & Associates (M&A) developed climate change scenarios and incorporated them into the Salinas Valley Operational Model (SVOM) Projected Baseline Simulation (M&A, 2026). These scenarios build on the future baseline model by applying California Department of Water Resources (DWR)-based scaling factors to precipitation, reference evapotranspiration (ET<sub>o</sub>), and surface water inputs to represent projected future conditions. Data was processed for all three 2070 DWR climate change scenarios: Central Tendency (CT), Dry with Extreme Warming (DEW), and Wet with Moderate Warming (WMW).

This memorandum describes the methodology used to implement the climate scenarios within the predictive modeling framework and summarizes the resulting model response, with a focus on changes in groundwater levels and pumping under the evaluated scenarios relative to the projected baseline model.

### METHODS

Climate change scenarios were developed using the water year (WY) sequence as defined in the future baseline model, which reflects conditions without climate change. This future baseline model corresponds to the Salinas Valley Operational Model Update and Projected Baseline Simulation (M&A, 2026).

Future climate change scenarios used DWR-provided datasets consisting of monthly scaling factors for precipitation, ETo, and streamflow. Consistent with this approach, scaling factors were also applied to tributary inflows and reservoir inflows to maintain alignment across all hydrologic inputs. These factors were applied multiplicatively to the future baseline model climate (precipitation and ETo) or hydrologic (tributary and reservoir inflows) inputs. This approach preserves the temporal sequencing of wet and dry periods from the base case model while adjusting the magnitude of precipitation, ETo, and surface water inputs to reflect projected future conditions. The method for scaling the precipitation and ETo inputs, the tributary flows, and the reservoir flows is outlined below. However, for simplicity, the results presented have static reservoir releases simulated to be the same as in the baseline model, because their influence on overall model response is expected to be minimal.

Change factors for each of the 3 climate change scenarios, CT, DEW, and WMW, were implemented using a linear transition from water year 2023 to water year 2070, such that scaling factors increase from 1.0 in 2022 to the full 2070 values by the end of the simulation period. The CT scenario represents the ensemble-average projection, while the DEW and WMW scenarios represent bounding dry/hot and wet/moderate conditions, respectively, and are intended to bracket the range of plausible future climate conditions

Scaling factors were applied to precipitation and ETo arrays, tributary inflows, and reservoir flows using the historical water year sequence and corresponding proxy years associated with the DWR climate datasets presented in Table 1.

The scaling factor applied in a given water year was calculated as a linear interpolation between baseline and 2070 conditions:

$$Factor_{WY} = 1.0 + \left( \frac{WY - 2023}{2072 - 2023} \right) \times (Factor_{2070} - 1.0)$$

where  $Factor_{WY}$  is the scaling factor for a given water year, and  $Factor_{2070}$  is the DWR-provided monthly factor for the selected climate scenario.

Table 1 summarizes the predictive period assumptions linking each modeled water year to a corresponding historical proxy year. The Water Year column represents the modeled predictive year, the Proxy Water Year column identifies the historical data used, and the Applied Climate Change Factor Water Year column reflects the DWR-derived adjustment when available. For years beyond 2011, when DWR change factors are not available, a Secondary Proxy Water Year column is used to define the applied change factor from a year prior to 2012. The predictive data in the future baseline model follows the proxy water year cycle.

Table 1. Predictive Hydrology Cycling and Associated DWR Climate Change Factor Year Assumption

Water Year	Proxy Water Year	Secondary Proxy Water Year	Applied Climate Change Factor Water Year
2023	1993	-	1993
2024	2019	2000	2000
2025	1975	-	1975
2026	1999	-	1999
2027	2000	-	2000
2028	2001	-	2001
2029	2002	-	2002
2030	2003	-	2003
2031	2004	-	2004
2032	2005	-	2005
2033	2006	-	2006
2034	2007	-	2007
2035	2008	-	2008
2036	2009	-	2009
2037	2010	-	2010
2038	2011	-	2011
2039	2012	1981	1981
2040	2013	1985	1985
2041	2014	1991	1991
2042	2015	2002	2002
2043	2016	1979	1979
2044	2017	1971	1971
2045	2018	2003	2003
2046	2019	2000	2000
2047	2020	1985	1985
2048	1993	-	1993
2049	2019	2000	2000
2050	1975	-	1975
2051	1999	-	1999
2052	2000	-	2000
2053	2001	-	2001
2054	2002	-	2002
2055	2003	-	2003
2056	2004	-	2004
2057	2005	-	2005
2058	2006	-	2006
2059	2007	-	2007
2060	2008	-	2008
2061	2009	-	2009
2062	2010	-	2010
2063	2011	-	2011
2064	2012	1981	1981
2065	2013	1985	1985
2066	2014	1991	1991
2067	2015	2002	2002
2068	2016	1979	1979
2069	2017	1971	1971
2070	2018	2003	2003
2071	2019	2000	2000
2072	2020	1985	1985

## Array Scaling

Monthly precipitation and ETo change factors from DWR were provided spatially as a grid (VIC grid) that has a smaller resolution than the future baseline model. The change factors that correspond to each VIC grid cell were assigned to model cells from the future baseline model based on which VIC grid cells contained their centroid. Future baseline grid cells to the northwest of the future baseline model domain near the coastline that did not have any overlapping VIC grid cells were assigned the closest VIC grid cell.

To apply the DWR change factors, the monthly arrays from the future baseline model were multiplied by the linearly scaled monthly change factors that corresponded to the assigned proxy water year or secondary proxy water year when needed. The process was repeated for each of climate change scenarios to produce scaled climate change arrays to input into the model (Figure 1).

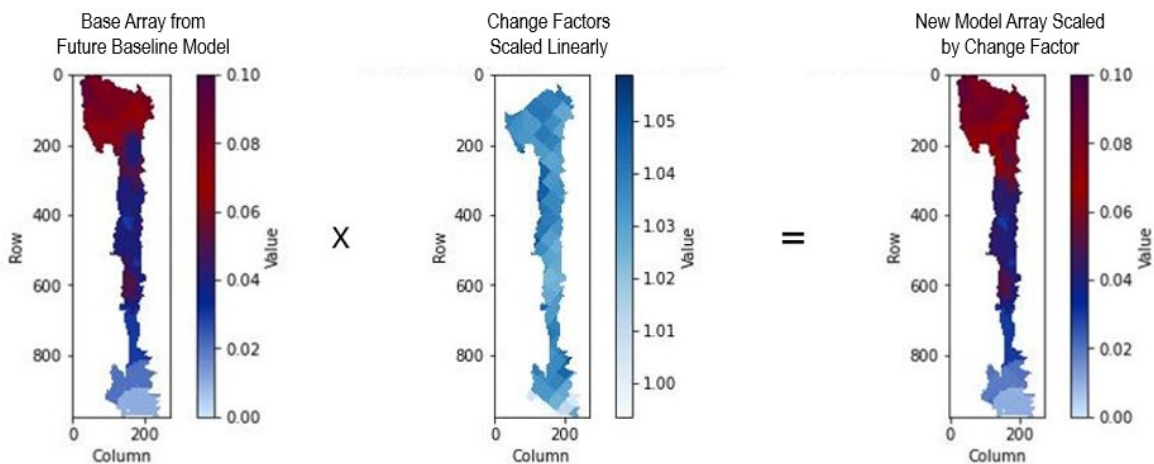


Figure 1. Example of Monthly Climate Change Factor Scaling from Base to Adjusted Array

## Tributary Scaling

Monthly streamflow change factors from DWR were provided for HUC-8 watersheds. The future baseline model falls primarily in the 18060005 HUC-8 watershed, with a small portion of tributaries in the northeast on the future baseline model located in the 18060011 HUC-8 watershed (Figure 2). The monthly streamflow change factors were scaled linearly from 2023 to 2070 using the method described above and multiplied to the historical data that is input into the model as tables.

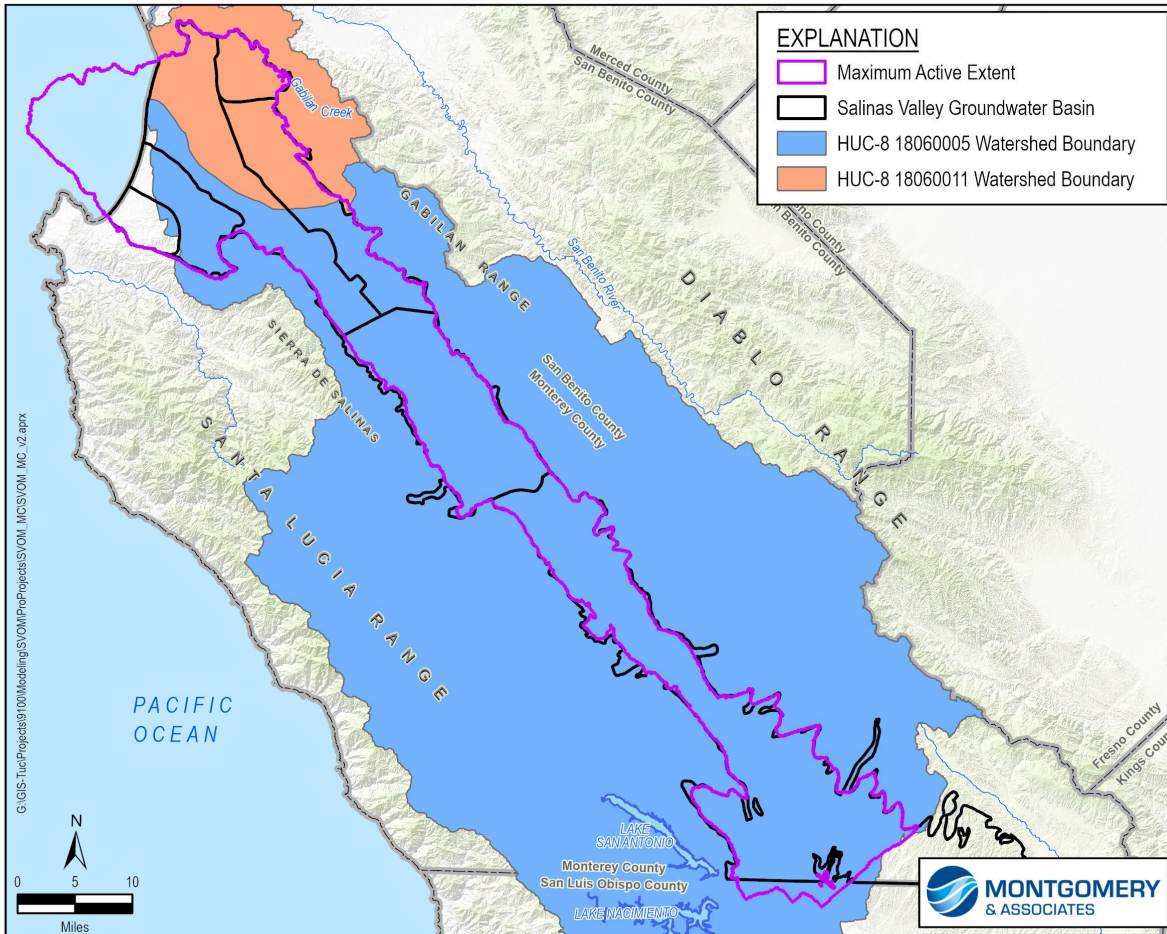


Figure 2. HUC-8 Watersheds Used in Streamflow Climate Change

## Reservoir Scaling

The reservoir model inputs consist of tables of data for precipitation, ETo, and streamflow. The linearly scaled change factors described above in the Array Scaling section and Tributary Scaling section are used to scale the reservoir data. The streamflow change factors for the 18060005 HUC-8 watershed are applied the same way as described above. A single VIC grid and its corresponding change factors were used to scale the precipitation and ETo arrays. The VIC grid chosen contains the dams for Nacimiento Reservoir and San Antonio Reservoir. With the single set of monthly change factors from the chosen VIC grid, the precipitation and ETo data were scaled by applying the linearly scaled change factors to the data table rather than spatially using arrays.

## Technical Notes: Translating Change Factors to the Grid (or SFR Segments)

For the precipitation and ETo scaling method, future baseline model cells are assigned to corresponding VIC grid cells in which their centroid is located. However, this method simplifies

the spatial distribution of the change factors for model cells that are located in multiple VIC grid cells. Additionally, change factors are being applied to coastline future baseline model cells that do not have any overlapping VIC grid. This may scale the historical data with change factors that are not representative for their location.

The majority of the tributaries that are scaled in the model are located in the 18060005 HUC-8 watershed; however, near the boundary of the 18060005 HUC-8 watershed and the 18060011 HUC-8 watershed, tributary segments cross into each watershed. For these segments, watershed change factors were assigned based on the watershed containing the greatest number of tributary model cells within each segment.

## **SUMMARY OF MODEL INPUTS**

Model inputs for precipitation, ETo, Salinas River streamflow, and tributary streamflow are summarized below. Spatial summaries focus on late-period conditions (2060–2070), presenting differences from the future baseline for each climate scenario. It is expected that late time in the projected period will have the greatest change from baseline conditions. The 2060–2070 range has higher averages than the 25-year average. While the trend observed between the 3 climate scenarios is the same for the 25-year range and the 10-year range, the 10-year range provides a more prominent difference for comparison. Monthly streamflow is presented to illustrate temporal variability in model inputs under each climate scenario.

Scaled precipitation and ETo arrays reflect the application of the DWR monthly scaling factors under the 3 climate scenarios. Time-averaged differences from the future baseline are shown on Figure 3 for precipitation and Figure 4 for ET. These spatial patterns are governed by the magnitude and distribution of the applied scaling factors.

For precipitation, the DEW scenario results in reduced precipitation across the central portion of the basin, with localized increases near the coast and at the upstream extent. Despite an overall reduction in basin-wide precipitation, the scenario exhibits notable spatial variability in change factors, including isolated inland increases. These patterns reflect both underlying climate model projections, such as shifts in storm tracks, precipitation distribution, and seasonal timing, and the application of monthly multiplicative scaling factors, which can amplify localized variability. Consistent with this variability, the DEW scenario also shows increases in precipitation during select months, indicative of a redistribution toward fewer, more intense events. Streamflow responds nonlinearly to these changes, such that increases in precipitation during specific periods can result in disproportionately higher runoff. As a result, some months exhibit elevated precipitation and streamflow despite an overall drying trend. The CT scenario remains generally consistent with the future baseline, with modest increases in precipitation, while the WMW scenario produces basin-wide increases relative to baseline conditions.

For ETo, all scenarios show increases relative to the future baseline, consistent with the DWR scaling factors. The DEW scenario produces the largest increases in ETo across the basin, reflecting hotter and drier conditions, while the CT scenario results in moderate, relatively uniform increases. The WMW scenario also shows increases in ETo, though generally less pronounced than DEW, with spatial patterns that are broadly consistent across the domain and reflect the distributed application of the scaling factors.

Monthly variability in tributary flow and Salinas River streamflow mirrors the precipitation patterns, with the largest changes occurring during peak runoff periods. The DEW and CT scenarios have a smaller magnitude change than the WMW scenario changes, particularly in the wetter winter months.

Figure 5 and Figure 6 show the historical flows, future baseline model flows, and the climate change scenario flows for the projection period water year 2023–2072. The values shown on Figure 6 are much larger than those presented on Figure 5 because it is a sum of all tributaries being modeled, but the magnitude of change for each scenario is consistent with the Salinas River results.

Overall, the monthly distributions across precipitation, ET, and streamflow inputs are consistent with the seasonal behavior and magnitude of change defined in the DWR climate change factor guidance.

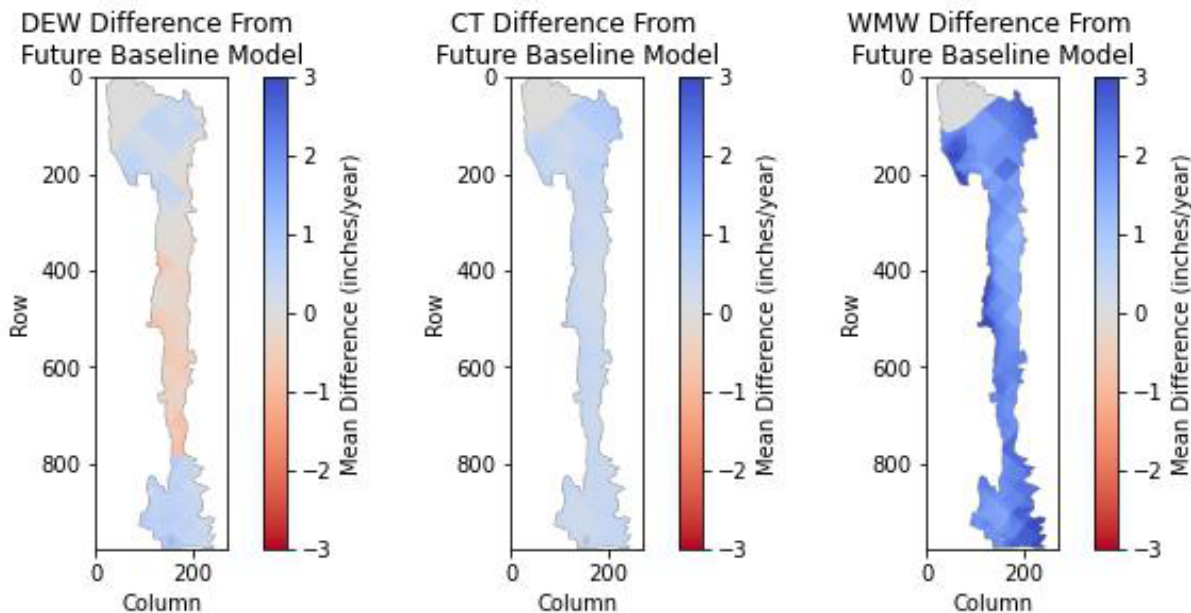


Figure 3. Mean Annual Precipitation Difference from Future Baseline Model for Late Time 2060–2070

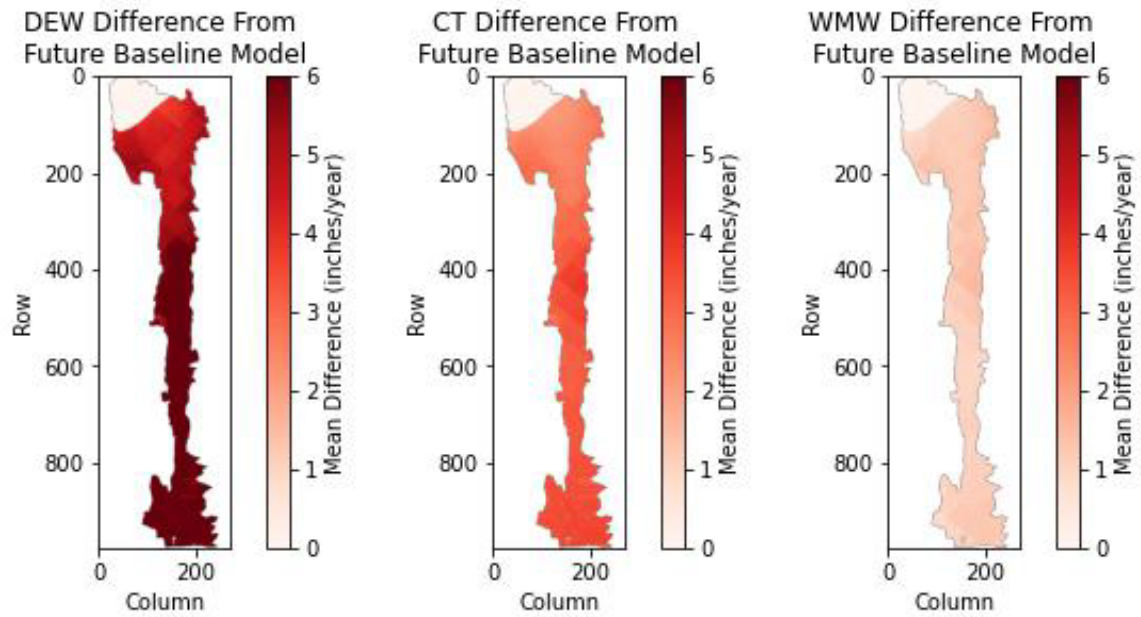


Figure 4. Mean Annual ET<sub>0</sub> Difference from Future Baseline Model for Late Time 2060–2070

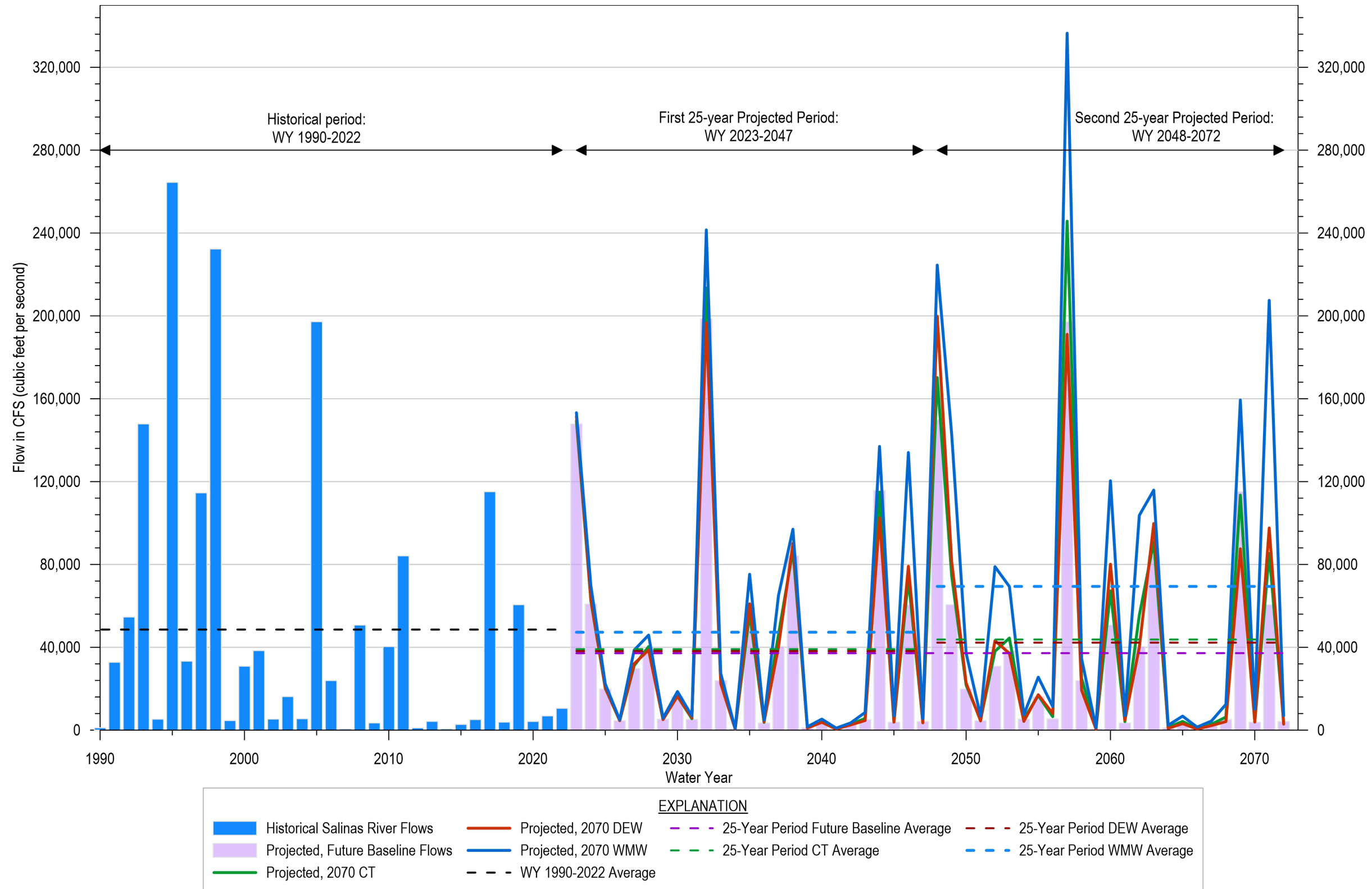


Figure 5. Salinas River Historical and Projected Flows

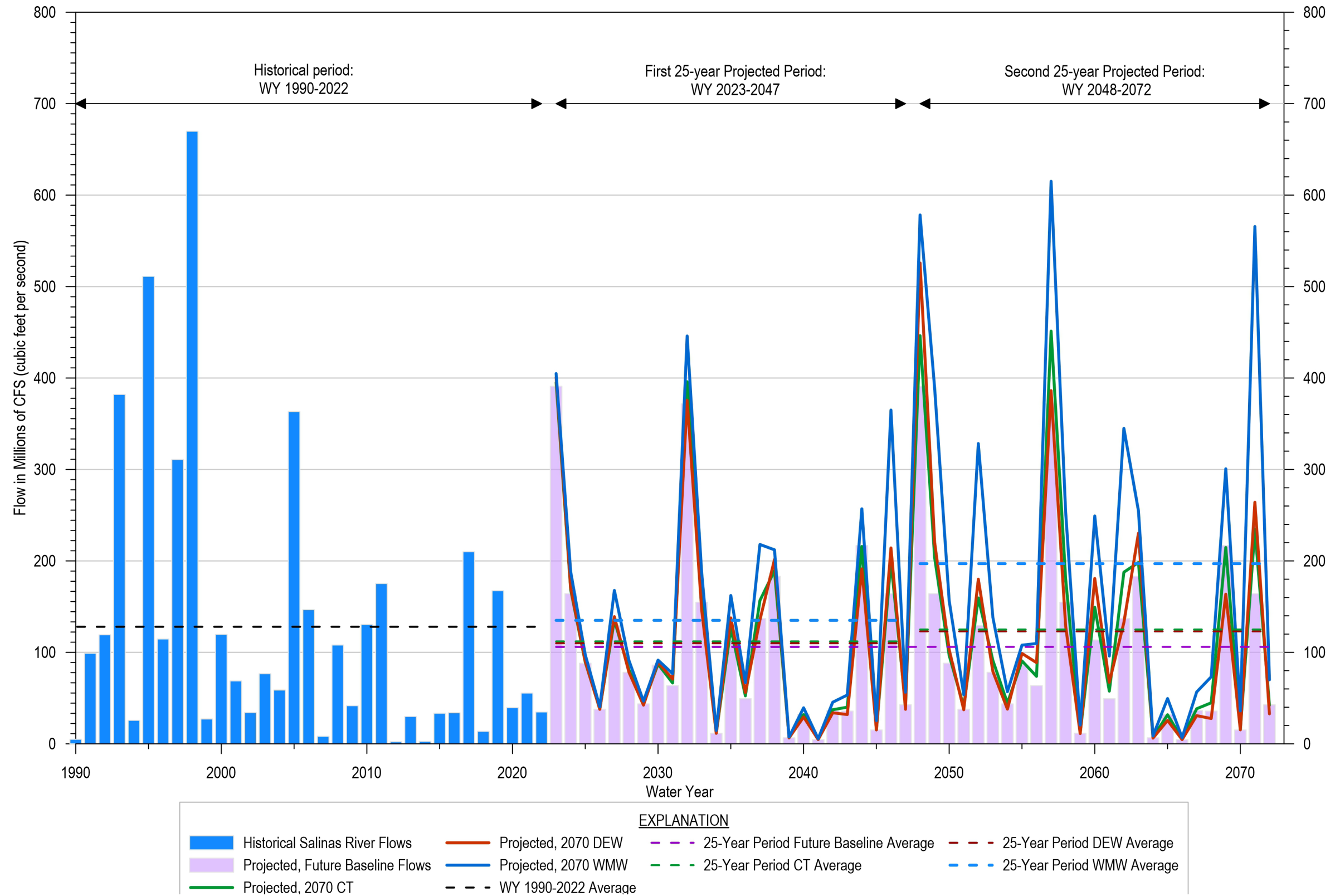


Figure 6. Historical and Projected Tributary Flows

## RESULTS

Model results are presented for simulations incorporating scaled precipitation and ETo arrays and scaled streamflow. Simulations including scaled reservoir inputs are not presented, because their influence on overall model response is expected to be minimal. Results include projected groundwater level differences relative to the future baseline for 2047, as well as monthly summaries of pumping, precipitation, and evapotranspiration. Model projections for pumping, precipitation, and evapotranspiration (ET) were processed from the FB Details model output and are aggregated by Water Balance Subregion (WBS) groups. The spatial distribution of individual WBS groups is shown on Figure 5; model output results for pumping, precipitation, and ET are presented for CSIP, Clark Colony, Forebay, North Valley, and the Upper Valley. Model-wide results presented include all WBS groups in the model domain.

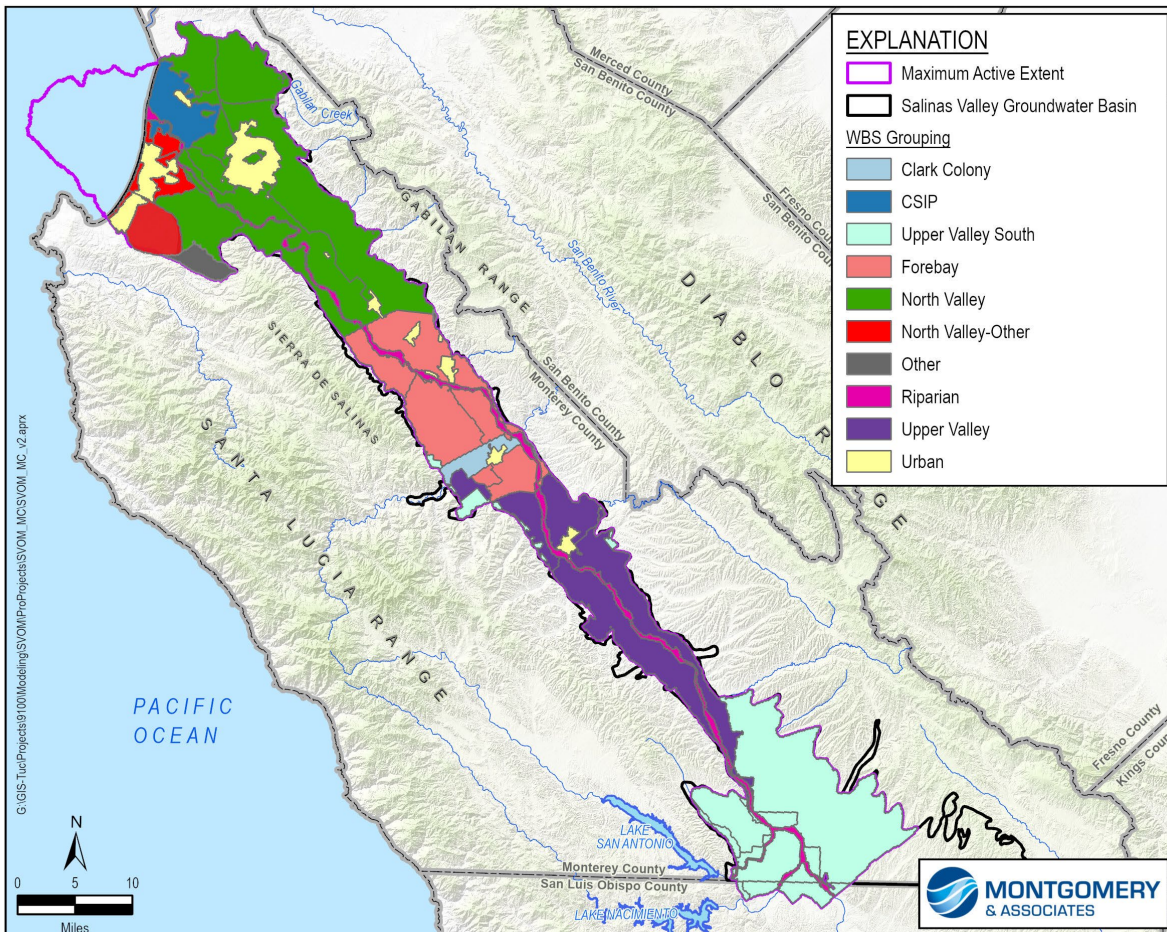


Figure 7. Map of WBS Groupings in the Salinas Valley Groundwater Basin

## Simulated Water Level Changes

Simulated groundwater level differences relative to the future baseline are presented on Figure 6, Figure 7, and Figure 8 for the 180-Foot Aquifer, 400-Foot Aquifer, and Deep Aquifers, respectively, for year 2047 under the 3 DWR climate scenarios. Negative values (redder) indicate groundwater level declines relative to the baseline, while positive values (greener) indicate groundwater level rises. Consistent with the DWR climate scenario framework, the DEW scenario produces the greatest groundwater level declines across all aquifers, reflecting reduced recharge and increased evapotranspiration under hotter, drier conditions. The CT scenario results in more moderate declines, but they are widespread relative to baseline conditions. In contrast, WMW scenario generally maintains groundwater levels similar to the future baseline, with localized areas of higher water levels corresponding to reduced pumping and increased recharge. Across all scenarios and aquifers, the largest deviations from the future baseline occur in the North Valley region, indicating greater sensitivity to climate-driven changes in recharge and water demand in this area.

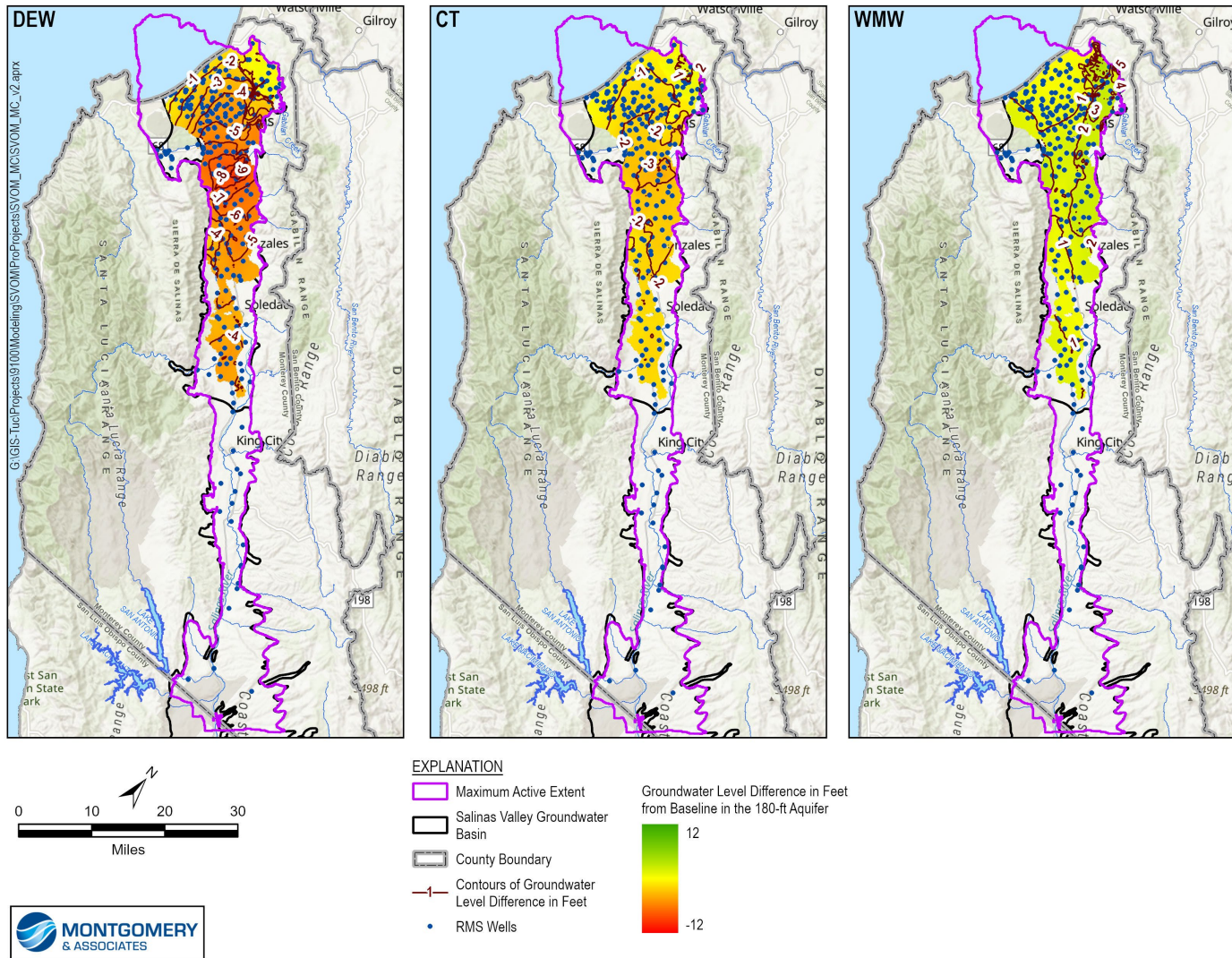


Figure 8. Groundwater Level Difference from Future Baseline in the 180-Foot Aquifer

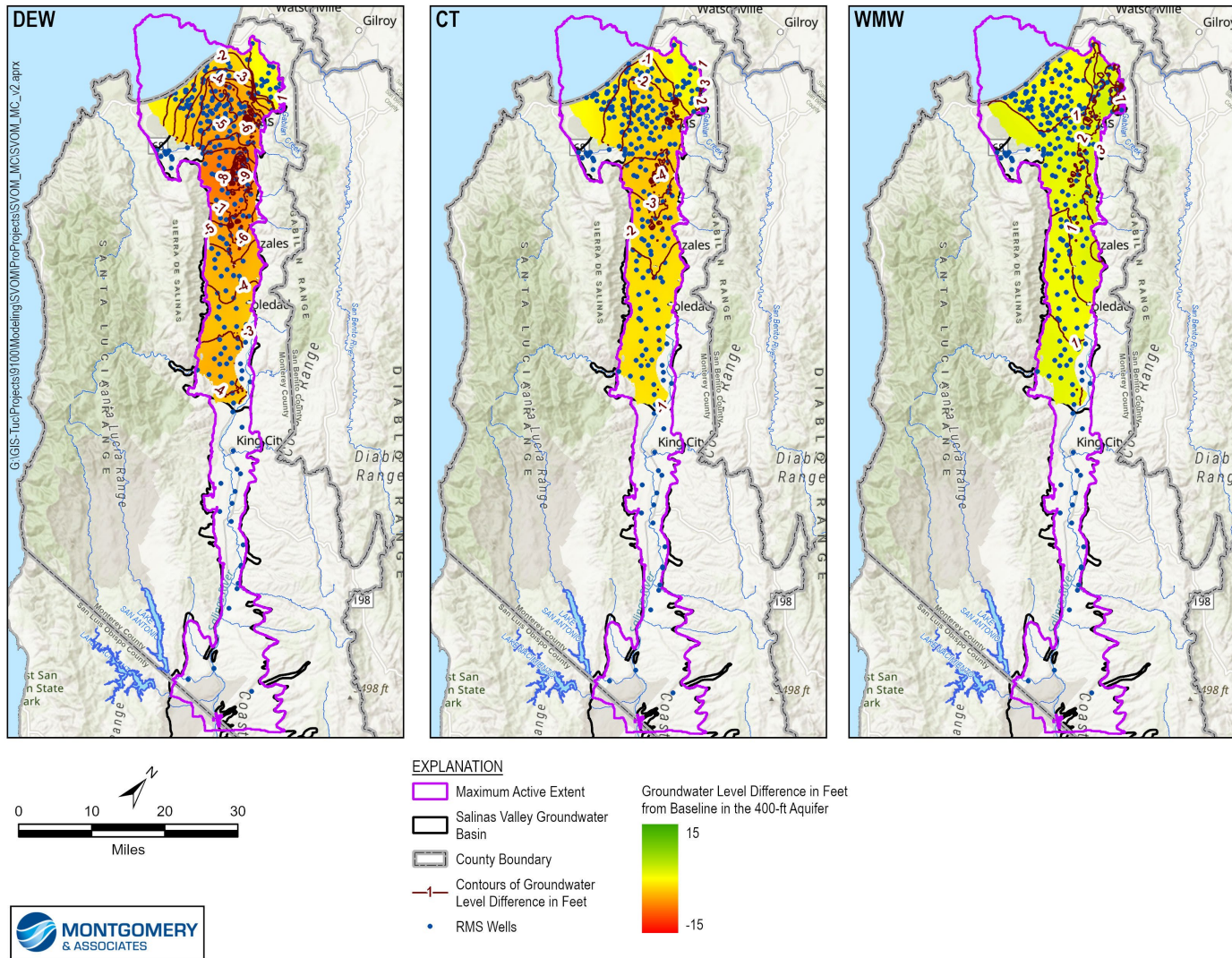


Figure 9. Groundwater Level Difference from Future Baseline in the 400-Foot Aquifer

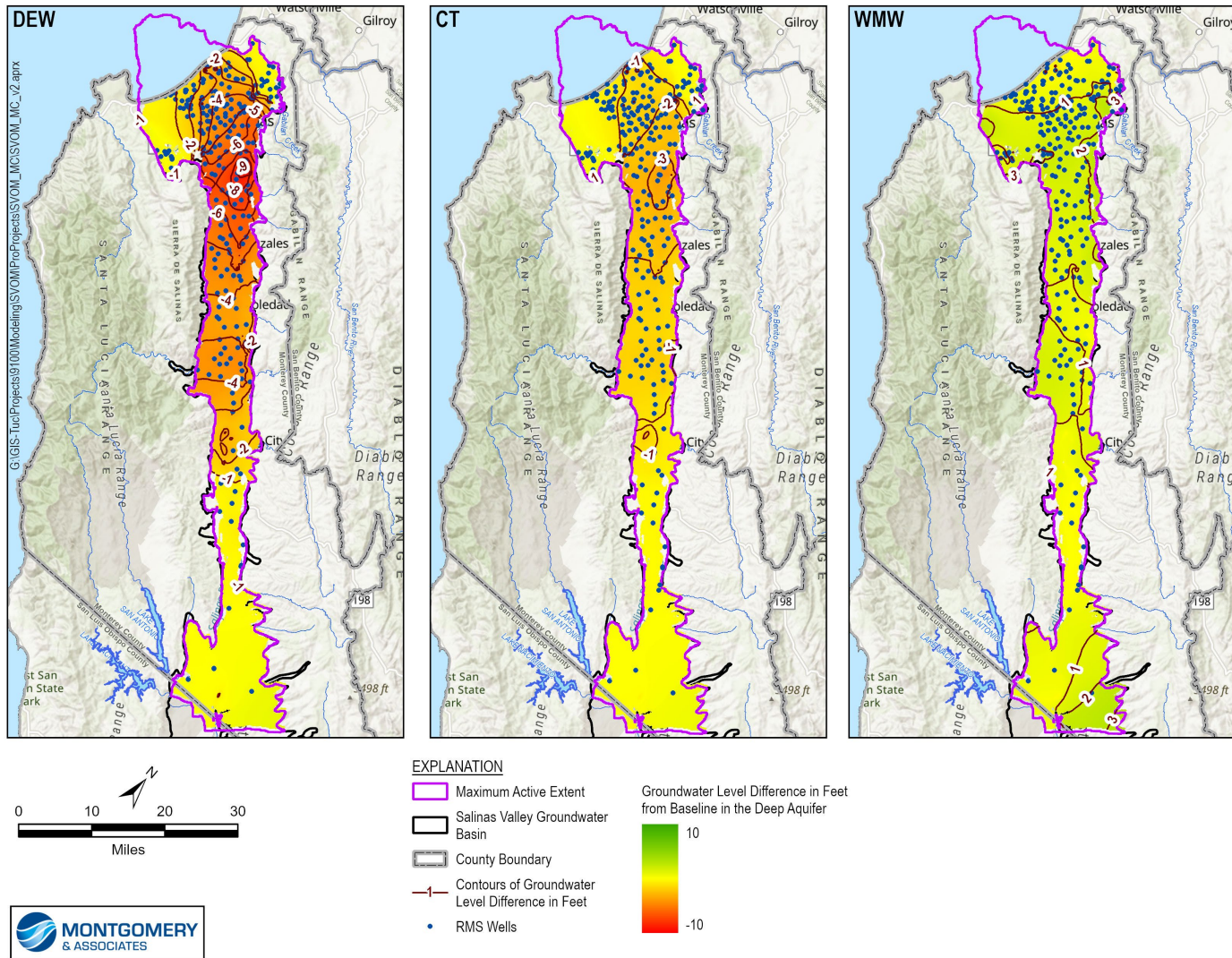


Figure 10. Groundwater Level Difference from Future Baseline in the Deep Aquifers

## **Projected Pumping Monthly Differences from Future Baseline**

Changes to ET and precipitation impact pumping required to meet crop consumptive use demand. Average annual pumping for the first 25-year period (2023–2047) and the later 25-year period (2047–2072) is presented by group in Table 4 and Table 5. Model-wide monthly pumping is presented in Attachment A for the future baseline model and each of the 3 climate scenarios.

## **Precipitation and ET Monthly Differences from Future Baseline**

Monthly summaries of precipitation and ET differences relative to the future baseline are presented in Table 6 through Table 9. The monthly patterns reflect the expected seasonal distribution of the DWR climate change factors. Precipitation changes are concentrated in the winter months when the majority of rainfall occurs, with the DEW scenario showing reductions and the CT and WMW scenarios showing incremental to substantial increases. ET differences are observed year-round, with the greatest increases during the warmer months, consistent with higher evaporative demand under future climate conditions. It is expected that the second 25-year period will be warmer than the first 25-year period. The average ET differences are greater in the second 25-year period than in the first 25-year period, in line with the expected long-term climate change.

While the DEW scenario follows the general trend outlined above, there are instances in the precipitation changes when the DEW scenario has more precipitation than the CT and WMW scenarios. It is noted that in the change factors from DWR that the 2070 DEW scenario has sections of time when the change factors increase to values between 2 and 4 while the other scenarios remain around 1. This occurs more frequently in the late time of the model. The sudden change in scaling factors in the DEW scenario is a likely reason for the unexpected differences between the scenarios. Under extreme climate change conditions, it could be expected to have intense wet periods and intense dry periods that could result in some months having short-term wetter conditions in the DEW scenario.

Table 2. Average Monthly Summaries of Pumping in Acre-Feet Relative to Future Baseline by WBS Group for Water Years 2023–2047

WBS Group	CSIP				North Valley				Forebay				Clark Colony				Upper Valley			
	Future Baseline	DEW minus FB	CT minus FB	WMW minus FB	Future Baseline	DEW minus FB	CT minus FB	WMW minus FB	Future Baseline	DEW minus FB	CT minus FB	WMW minus FB	Future Baseline	DEW minus FB	CT minus FB	WMW minus FB	Future Baseline	DEW minus FB	CT minus FB	WMW minus FB
1	107.567	10.657	1.572	-0.476	3726.275	111.870	5.017	6.508	2923.098	138.823	7.511	21.702	197.728	11.993	0.222	-0.277	1563.205	107.229	-0.805	6.358
2	9.687	8.144	0.496	-6.369	4214.200	71.745	26.520	-224.481	3752.754	121.311	33.559	-233.448	248.010	11.161	3.636	-20.830	2186.615	104.545	40.783	-160.942
3	9.581	4.066	0.219	-5.337	8257.135	98.226	19.406	2.678	7170.974	152.919	59.455	-80.614	545.155	13.833	5.324	-11.280	5502.144	106.022	36.230	-160.261
4	121.889	14.651	6.606	-25.147	13905.629	323.171	271.511	-65.283	11770.277	375.481	223.356	-75.371	747.013	32.380	20.641	-7.165	9155.038	285.989	174.899	-59.986
5	376.049	58.463	24.216	-14.036	20715.846	747.328	520.334	112.065	15601.672	636.105	446.333	-4.264	1010.637	57.981	37.189	0.174	12939.745	577.807	353.107	38.711
6	720.214	81.004	46.495	36.644	24771.225	813.457	499.910	596.716	17087.055	744.046	425.489	379.518	709.348	62.087	34.148	28.664	13605.537	535.132	324.196	298.516
7	930.238	93.712	56.564	16.990	28232.106	486.769	441.405	271.663	19105.628	458.140	414.018	190.546	1187.009	38.507	34.236	14.845	14680.230	298.822	248.797	107.465
8	804.753	93.067	42.611	7.122	25168.168	831.425	526.713	251.423	17312.087	839.444	437.705	282.720	1278.419	69.829	37.481	22.563	13871.190	385.251	279.710	132.370
9	670.295	90.128	40.571	19.962	18594.670	755.995	403.573	228.970	13076.184	754.868	299.301	206.626	1060.399	46.236	26.649	16.828	11197.080	428.446	220.146	101.835
10	231.430	55.806	23.845	6.132	9266.283	897.971	441.507	267.842	6917.705	533.238	255.935	103.207	579.930	51.382	23.612	8.991	5935.540	453.856	217.155	68.278
11	134.775	78.457	11.928	-0.972	4661.459	812.208	192.822	-186.074	4161.991	636.312	158.101	-17.645	282.850	56.874	13.687	-0.927	2482.317	531.818	135.163	15.352
12	106.689	13.192	3.666	-0.543	2786.556	100.507	30.565	45.636	2525.886	90.304	31.103	21.517	170.809	9.169	2.971	1.961	1342.240	69.941	24.731	3.326
<b>Total</b>	<b>4223.168</b>	<b>601.346</b>	<b>258.790</b>	<b>33.972</b>	<b>164299.553</b>	<b>6050.669</b>	<b>3379.286</b>	<b>1307.664</b>	<b>121405.310</b>	<b>5260.991</b>	<b>2791.866</b>	<b>794.494</b>	<b>8017.306</b>	<b>461.432</b>	<b>239.797</b>	<b>53.548</b>	<b>94460.881</b>	<b>3884.859</b>	<b>2054.111</b>	<b>391.023</b>

Table 3. Average Monthly Summaries of Pumping in Acre-Feet Relative to Future Baseline by WBS Group for Water Years 2048–2072

WBS Group	CSIP				North Valley				Forebay				Clark Colony				Upper Valley			
	Future Baseline	DEW minus FB	CT minus FB	WMW minus FB	Future Baseline	DEW minus FB	CT minus FB	WMW minus FB	Future Baseline	DEW minus FB	CT minus FB	WMW minus FB	Future Baseline	DEW minus FB	CT minus FB	WMW minus FB	Future Baseline	DEW minus FB	CT minus FB	WMW minus FB
1	108.968	33.459	4.029	-1.755	3728.817	319.445	20.027	58.487	2922.632	401.555	27.518	90.058	197.669	32.791	1.072	1.191	1562.381	290.720	4.460	30.265
2	12.312	22.464	0.989	-11.454	4238.511	178.793	59.291	-511.298	3768.794	330.249	79.089	-430.445	249.303	30.804	8.772	-38.421	2197.245	316.580	104.408	-324.971
3	10.494	10.394	0.459	-7.447	8274.028	274.518	62.307	30.206	7179.914	425.218	168.412	-230.768	545.573	36.495	14.593	-30.008	5502.936	309.439	109.589	-424.765
4	117.248	44.693	15.282	-60.967	13953.055	942.865	755.974	-182.576	11792.753	1095.664	634.305	-227.135	747.771	93.617	56.155	-18.277	9156.832	867.373	503.988	-165.486
5	433.393	241.579	80.028	-40.834	20758.398	2045.228	1441.504	314.106	15614.484	1745.328	1225.594	-35.133	1011.074	159.660	102.766	-0.471	12937.547	1587.281	960.621	117.956
6	830.312	368.115	130.742	91.123	24800.521	2306.515	1406.003	1644.627	17095.584	2089.140	1188.179	1034.124	709.953	172.360	94.016	76.492	13604.385	1507.874	908.033	820.287
7	1040.890	462.387	165.447	22.927	28259.999	1366.325	1222.429	749.201	19119.759	1269.791	1148.249	518.004	1187.927	107.036	95.057	39.424	14686.792	837.177	692.523	290.359
8	967.145	454.526	173.488	-1.839	25188.926	2338.468	1459.394	614.074	17324.619	2320.409	1208.968	779.698	1279.101	192.817	103.680	61.751	13879.685	1069.853	772.328	356.660
9	835.325	455.501	184.923	47.688	18622.292	2079.075	1099.627	607.877	13103.294	1473.962	817.109	555.716	1068.174	127.181	72.467	44.182	11215.726	1163.183	602.155	254.845
10	241.916	411.216	103.462	24.109	9275.491	2595.809	1268.891	825.254	6924.569	1577.087	735.921	322.379	580.274	151.175	66.654	26.406	5941.363	1411.222	632.148	239.670
11	135.576	337.453	49.551	0.466	4665.008	2752.339	580.428	-304.937	4164.819	1942.249	479.642	49.010	282.942	171.464	39.374	2.639	2484.824	1680.896	418.872	85.696
12	107.813	53.181	12.926	3.660	2788.927	346.870	108.538	190.933	2527.421	290.810	98.676	123.007	170.839	29.706	9.236	10.902	1343.907	214.448	77.051	64.210
<b>Total</b>	<b>4841.392</b>	<b>2894.970</b>	<b>921.327</b>	<b>65.678</b>	<b>164553.973</b>	<b>17546.250</b>	<b>9484.413</b>	<b>4035.953</b>	<b>121538.642</b>	<b>14961.464</b>	<b>7811.662</b>	<b>2548.514</b>	<b>8030.598</b>	<b>1305.106</b>	<b>663.842</b>	<b>175.810</b>	<b>94513.622</b>	<b>11256.046</b>	<b>5786.176</b>	<b>1344.728</b>

Table 4. Average Monthly Summaries of Precipitation in Inches Relative to Future Baseline by WBS Group for Water Years 2023–2047

WBS Group	CSIP				North Valley				Forebay				Clark Colony				Upper Valley			
	Future Baseline	DEW minus FB	CT minus FB	WMW minus FB	Future Baseline	DEW minus FB	CT minus FB	WMW minus FB	Future Baseline	DEW minus FB	CT minus FB	WMW minus FB	Future Baseline	DEW minus FB	CT minus FB	WMW minus FB	Future Baseline	DEW minus FB	CT minus FB	WMW minus FB
1	3.056	0.019	0.153	0.197	2.503	0.011	0.128	0.161	1.974	-0.002	0.109	0.192	2.332	-0.004	0.134	0.250	1.997	-0.006	0.124	0.190
2	3.189	0.433	0.087	0.350	2.590	0.310	0.072	0.327	2.088	0.205	0.063	0.317	2.506	0.238	0.069	0.357	2.007	0.133	0.041	0.255
3	2.583	0.071	0.070	0.011	2.075	0.040	0.047	0.003	1.550	0.028	0.031	0.053	1.805	0.031	0.037	0.088	1.495	0.025	0.039	0.128
4	1.299	-0.013	-0.041	-0.015	1.027	0.014	-0.029	-0.014	0.692	0.020	-0.015	-0.003	0.812	0.026	-0.019	-0.006	0.642	0.021	-0.013	-0.023
5	0.452	0.012	-0.023	-0.026	0.363	0.002	-0.022	-0.019	0.235	-0.013	-0.023	-0.011	0.257	-0.012	-0.014	-0.015	0.209	0.005	-0.017	-0.016
6	0.106	-0.014	-0.006	-0.005	0.074	-0.010	-0.004	-0.004	0.044	-0.007	-0.002	0.000	0.048	-0.007	-0.002	0.000	0.038	-0.005	-0.002	-0.002
7	0.026	0.002	0.001	-0.001	0.016	0.001	0.000	0.000	0.009	0.000	0.000	0.000	0.009	0.000	0.000	0.000	0.014	0.000	0.000	0.000
8	0.043	-0.001	0.002	0.007	0.026	-0.001	0.001	0.003	0.016	0.000	0.000	-0.001	0.016	0.000	0.000	-0.001	0.009	0.000	0.000	-0.001
9	0.058	-0.005	0.002	0.007	0.043	-0.005	0.002	0.006	0.025	-0.001	0.001	0.011	0.026	0.000	0.001	0.012	0.022	0.001	0.000	0.008
10	0.826	-0.130	-0.054	-0.074	0.676	-0.105	-0.044	-0.060	0.482	-0.074	-0.019	-0.028	0.548	-0.088	-0.018	-0.016	0.442	-0.068	-0.014	0.002
11	1.531	-0.248	-0.036	0.103	1.240	-0.207	-0.034	0.087	0.910	-0.183	-0.033	0.020	1.039	-0.206	-0.037	0.019	0.783	-0.164	-0.041	-0.013
12	3.022	0.044	0.084	0.106	2.524	0.043	0.067	0.128	2.018	0.032	0.033	0.091	2.263	0.026	0.035	0.116	1.778	0.048	0.022	0.090
<b>Total</b>	<b>16.192</b>	<b>0.170</b>	<b>0.240</b>	<b>0.660</b>	<b>13.156</b>	<b>0.095</b>	<b>0.185</b>	<b>0.619</b>	<b>10.044</b>	<b>0.006</b>	<b>0.146</b>	<b>0.640</b>	<b>11.661</b>	<b>0.004</b>	<b>0.186</b>	<b>0.804</b>	<b>9.435</b>	<b>-0.011</b>	<b>0.140</b>	<b>0.619</b>

Table 5. Average Monthly Summaries of Precipitation in Inches Relative to Future Baseline by WBS Group for Water Years 2048–2072

WBS Group	CSIP				North Valley				Forebay				Clark Colony				Upper Valley			
	Future Baseline	DEW minus FB	CT minus FB	WMW minus FB	Future Baseline	DEW minus FB	CT minus FB	WMW minus FB	Future Baseline	DEW minus FB	CT minus FB	WMW minus FB	Future Baseline	DEW minus FB	CT minus FB	WMW minus FB	Future Baseline	DEW minus FB	CT minus FB	WMW minus FB
1	3.056	0.115	0.457	0.581	2.503	0.082	0.382	0.482	1.974	0.065	0.318	0.549	2.332	0.067	0.384	0.710	1.997	0.028	0.352	0.531
2	3.179	1.230	0.283	1.119	2.583	0.892	0.238	1.075	2.085	0.609	0.217	1.103	2.502	0.716	0.242	1.266	2.003	0.438	0.152	0.864
3	2.583	0.168	0.178	0.030	2.075	0.094	0.123	0.005	1.550	0.073	0.089	0.151	1.805	0.074	0.103	0.241	1.495	0.054	0.099	0.344
4	1.299	-0.019	-0.106	-0.069	1.027	0.033	-0.078	-0.052	0.692	0.035	-0.047	-0.021	0.812	0.036	-0.060	-0.033	0.642	0.027	-0.044	-0.074
5	0.452	0.047	-0.063	-0.079	0.363	0.018	-0.063	-0.057	0.235	-0.029	-0.063	-0.034	0.257	-0.028	-0.040	-0.046	0.209	0.024	-0.045	-0.050
6	0.106	-0.046	-0.019	-0.017	0.074	-0.031	-0.014	-0.013	0.044	-0.023	-0.006	-0.001	0.048	-0.024	-0.007	0.001	0.038	-0.017	-0.006	-0.006
7	0.026	0.006	0.002	-0.002	0.016	0.005	0.001	-0.001	0.009	0.001	0.001	0.000	0.009	0.001	0.001	0.000	0.014	0.000	0.000	0.000
8	0.043	-0.006	0.008	0.054	0.026	-0.004	0.005	0.027	0.016	-0.001	0.001	-0.003	0.016	-0.001	0.000	-0.006	0.009	-0.001	0.000	-0.003
9	0.056	-0.014	0.006	0.018	0.042	-0.014	0.005	0.017	0.024	-0.002	0.003	0.034	0.025	0.000	0.003	0.039	0.021	0.005	0.001	0.026
10	0.826	-0.367	-0.146	-0.221	0.676	-0.300	-0.122	-0.183	0.482	-0.227	-0.052	-0.087	0.548	-0.275	-0.052	-0.044	0.442	-0.221	-0.040	0.001
11	1.531	-0.716	-0.106	0.270	1.240	-0.600	-0.099	0.224	0.910	-0.528	-0.097	0.032	1.039	-0.600	-0.111	0.030	0.783	-0.474	-0.119	-0.047
12	3.022	0.199	0.240	0.359	2.524	0.175	0.197	0.397	2.018	0.114	0.099	0.250	2.263	0.092	0.101	0.315	1.778	0.162	0.069	0.231
<b>Total</b>	<b>16.180</b>	<b>0.597</b>	<b>0.733</b>	<b>2.043</b>	<b>13.148</b>	<b>0.348</b>	<b>0.575</b>	<b>1.922</b>	<b>10.039</b>	<b>0.087</b>	<b>0.462</b>	<b>1.976</b>	<b>11.656</b>	<b>0.058</b>	<b>0.566</b>	<b>2.474</b>	<b>9.431</b>	<b>0.023</b>	<b>0.418</b>	<b>1.817</b>

Table 6. Average Monthly Summaries of ET in Inches Relative to Future Baseline by WBS Group for Water Years 2023–2047

WBS Group	CSIP				North Valley				Forebay				Clark Colony				Upper Valley			
	Future Baseline	DEW minus FB	CT minus FB	WMW minus FB	Future Baseline	DEW minus FB	CT minus FB	WMW minus FB	Future Baseline	DEW minus FB	CT minus FB	WMW minus FB	Future Baseline	DEW minus FB	CT minus FB	WMW minus FB	Future Baseline	DEW minus FB	CT minus FB	WMW minus FB
1	0.918	0.048	0.022	0.011	0.777	0.035	0.019	0.007	0.750	0.034	0.020	0.008	0.808	0.042	0.021	0.010	0.627	0.030	0.016	0.004
2	1.196	0.040	0.020	0.011	1.056	0.041	0.019	0.026	1.027	0.042	0.019	0.020	1.113	0.049	0.020	0.011	0.875	0.039	0.016	0.027
3	1.871	0.054	0.030	0.038	1.396	0.034	0.024	0.007	1.410	0.037	0.025	0.020	1.596	0.049	0.031	0.021	1.198	0.034	0.025	0.035
4	2.138	0.045	0.027	0.028	1.391	0.028	0.002	-0.004	1.745	0.058	0.020	-0.005	2.069	0.073	0.025	-0.014	1.353	0.044	0.013	-0.012
5	2.427	0.067	0.028	0.004	1.650	0.050	0.012	-0.005	2.205	0.070	0.037	-0.007	2.489	0.086	0.050	-0.012	1.541	0.066	0.022	-0.005
6	2.429	0.029	0.028	0.066	1.695	0.042	0.028	0.038	2.400	0.091	0.055	0.055	2.666	0.106	0.062	0.057	1.539	0.050	0.033	0.035
7	2.451	0.019	0.018	0.025	1.822	0.031	0.028	0.019	2.622	0.060	0.055	0.027	2.848	0.065	0.058	0.027	1.605	0.030	0.026	0.015
8	2.248	0.050	0.031	0.018	1.633	0.051	0.035	0.021	2.380	0.112	0.059	0.039	2.647	0.119	0.064	0.039	1.502	0.039	0.029	0.016
9	1.872	0.062	0.039	0.034	1.231	0.042	0.027	0.022	1.817	0.071	0.041	0.040	2.090	0.079	0.047	0.042	1.242	0.045	0.023	0.021
10	1.424	0.032	0.019	-0.014	0.988	0.000	0.004	-0.014	1.243	0.029	0.023	-0.003	1.436	0.040	0.030	0.004	0.921	0.013	0.015	0.006
11	0.968	0.021	0.020	0.014	0.789	-0.019	0.008	0.025	0.809	-0.002	0.010	0.008	0.872	0.014	0.014	0.005	0.618	-0.013	0.001	-0.001
12	0.784	0.052	0.022	-0.003	0.668	0.041	0.016	-0.006	0.652	0.042	0.016	-0.007	0.691	0.045	0.016	-0.007	0.528	0.035	0.012	0.001
<b>Total</b>	<b>20.725</b>	<b>0.519</b>	<b>0.304</b>	<b>0.231</b>	<b>15.097</b>	<b>0.377</b>	<b>0.222</b>	<b>0.134</b>	<b>19.059</b>	<b>0.644</b>	<b>0.381</b>	<b>0.195</b>	<b>21.327</b>	<b>0.766</b>	<b>0.438</b>	<b>0.182</b>	<b>13.549</b>	<b>0.412</b>	<b>0.231</b>	<b>0.142</b>

Table 7. Average Monthly Summaries of ET in Inches Relative to Future Baseline by WBS Group for Water Years 2048–2072

WBS Group	CSIP				North Valley				Forebay				Clark Colony				Upper Valley			
	Future Baseline	DEW minus FB	CT minus FB	WMW minus FB	Future Baseline	DEW minus FB	CT minus FB	WMW minus FB	Future Baseline	DEW minus FB	CT minus FB	WMW minus FB	Future Baseline	DEW minus FB	CT minus FB	WMW minus FB	Future Baseline	DEW minus FB	CT minus FB	WMW minus FB
1	0.918	0.136	0.062	0.029	0.776	0.098	0.051	0.017	0.750	0.092	0.055	0.019	0.808	0.115	0.058	0.023	0.628	0.084	0.045	0.010
2	1.197	0.113	0.056	0.027	1.055	0.113	0.053	0.051	1.027	0.115	0.054	0.028	1.114	0.134	0.058	0.006	0.875	0.103	0.045	0.042
3	1.868	0.151	0.084	0.106	1.395	0.087	0.064	0.015	1.409	0.099	0.070	0.055	1.596	0.131	0.085	0.056	1.198	0.089	0.067	0.091
4	2.133	0.145	0.080	0.090	1.389	0.077	0.007	-0.011	1.743	0.153	0.053	-0.019	2.069	0.193	0.068	-0.046	1.353	0.109	0.034	-0.038
5	2.423	0.201	0.080	0.034	1.649	0.146	0.033	-0.013	2.203	0.196	0.101	-0.020	2.489	0.241	0.135	-0.037	1.541	0.193	0.062	-0.014
6	2.433	0.079	0.077	0.184	1.694	0.114	0.077	0.105	2.399	0.252	0.152	0.152	2.666	0.294	0.170	0.157	1.539	0.139	0.091	0.099
7	2.432	0.042	0.046	0.063	1.821	0.089	0.078	0.054	2.621	0.166	0.154	0.077	2.849	0.181	0.162	0.075	1.604	0.083	0.072	0.043
8	2.246	0.120	0.085	0.063	1.633	0.142	0.098	0.068	2.379	0.308	0.163	0.107	2.647	0.327	0.177	0.105	1.500	0.108	0.080	0.045
9	1.869	0.154	0.102	0.090	1.229	0.116	0.074	0.060	1.817	0.194	0.112	0.112	2.092	0.216	0.127	0.117	1.240	0.125	0.063	0.062
10	1.423	0.086	0.055	-0.040	0.988	-0.006	0.012	-0.045	1.241	0.077	0.068	-0.008	1.436	0.106	0.087	0.014	0.919	0.024	0.042	0.014
11	0.968	0.026	0.054	0.030	0.789	-0.085	0.021	0.056	0.808	-0.018	0.027	0.014	0.872	0.025	0.038	0.009	0.617	-0.051	0.003	-0.006
12	0.784	0.151	0.061	-0.008	0.668	0.114	0.046	-0.019	0.651	0.115	0.044	-0.023	0.691	0.125	0.047	-0.022	0.528	0.098	0.035	-0.001
<b>Total</b>	<b>20.693</b>	<b>1.403</b>	<b>0.842</b>	<b>0.670</b>	<b>15.088</b>	<b>1.006</b>	<b>0.614</b>	<b>0.338</b>	<b>19.047</b>	<b>1.749</b>	<b>1.053</b>	<b>0.493</b>	<b>21.329</b>	<b>2.087</b>	<b>1.212</b>	<b>0.457</b>	<b>13.542</b>	<b>1.106</b>	<b>0.638</b>	<b>0.347</b>

## CONCLUSIONS

Three climate change scenarios were simulated with the SVOM projected baseline model using DWR monthly scaling factors applied to precipitation, ET, and streamflow inputs. The approach preserved the temporal sequencing of historical hydrology while adjusting input magnitudes to reflect projected future conditions under 3 scenarios: CT, DEW, and WMW. Application of the DWR scaling factors resulted in spatial and temporal changes in model inputs consistent with expectations. Precipitation changes were primarily expressed during winter months, with reductions under the DEW scenario and increases under the CT and WMW scenarios. ET increased across all scenarios, with the largest increases under DEW, reflecting higher temperatures and evaporative demand. Tributary flows and Salinas River streamflow responded similarly to precipitation, with the greatest variability occurring during peak runoff periods.

Future climate conditions will impact surface water inflows (tributaries, the Salinas River, and reservoirs) to the basin, recharge, and crop consumptive use demand. Increased ET and reduced precipitation under the DEW scenario result in higher pumping requirements, particularly in later simulation periods. In contrast, the WMW scenario moderates pumping demand relative to baseline conditions, reflecting increased water availability. These changes in simulated pumping requirements translate directly into differences in future projected groundwater levels (relative to the future baseline scenario, without climate change) indicating that increased pumping would be required to sustain existing cropping patterns under future conditions. As previously mentioned, there is some uncertainty surrounding the DEW scenario trends when the DEW scenario is wetter than the CT and WMW scenarios. Despite the uncertainty in the precipitation changes, the pumping results are consistent with what would be expected.

Simulated groundwater responses reflect these changes in hydrologic inputs. The DEW scenario produces the greatest groundwater level declines across all aquifers, driven by reduced recharge and increased ET demand. The CT scenario results in moderate, basin-wide declines, while the WMW scenario generally maintains groundwater levels similar to the future baseline, with localized improvements associated with increased recharge and reduced pumping. Across all scenarios, the North Valley region exhibits the greatest sensitivity to climate-driven changes, with the largest deviations from baseline conditions.

Overall, the range of model responses across the 3 DWR scenarios brackets plausible future climate conditions and provides a consistent, scenario-based framework for evaluating potential impacts to groundwater levels, water supply, and system operations under changing climate conditions.

## RECOMMENDATIONS

Based on the results of this evaluation, the following next steps could be pursued to further refine the climate change analysis and better characterize model uncertainty:

- Conduct additional uncertainty evaluation, including sensitivity testing of the predictive hydrologic year cycling assumptions used to link modeled years to historical proxy years. This would help assess how strongly results are influenced by the selected hydrologic sequence in addition to the applied climate change factors.
- Further evaluate anomalous spatial patterns in the DWR climate change factors, particularly within the DEW scenario. Additional review is recommended to confirm that the localized precipitation patterns and resulting model input responses are appropriate and consistent with the intended use of the DWR dataset.
- Review and incorporate reservoir scaling results into the overall evaluation. The results presented reflect reservoir releases that are represented under the future baseline conditions (i.e., without climate change scaling). Although reservoir-input effects are expected to be limited relative to other scaled inputs, incorporating those results would provide a more complete assessment of climate change impacts on the modeled system.
- Figure 6, Figure 7, and Figure 8 can be used to estimate differences in simulated groundwater levels resulting from different future climate conditions. The impacts of future projected climate conditions on sustainability should be quantified by tabulating Minimum Threshold (MT) exceedances in each scenario.
- The model simulations described here do not include planned Projects and Management Actions (PMA). The comparisons shown in this memo provide an indication of sensitivity of future projected groundwater levels to different climate conditions but do not by themselves demonstrate whether planned PMAs will be sufficient to achieve sustainability. To answer this question, the future simulations described here will need to be re-run incorporating one or more planned PMA scenarios.

Together, these additional evaluations would strengthen confidence in the scenario implementation and help better constrain the range of plausible future model responses.

## REFERENCES

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- M&A. 2026. Salinas Valley Operational Model Update and Projected Baseline Simulation. Prepared for: Salinas Valley Basin Groundwater Sustainability Agency.

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California Department of Water Resources (DWR). 2025b. SGMA Climate Change Resources: Statewide streamflow change factor datasets for SGMA implementation. Available at: <https://sgma.water.ca.gov/webgis/config/custom/html/SGMADataViewer/doc/>



## **Attachment 1**

### **Monthly Average Pumping**

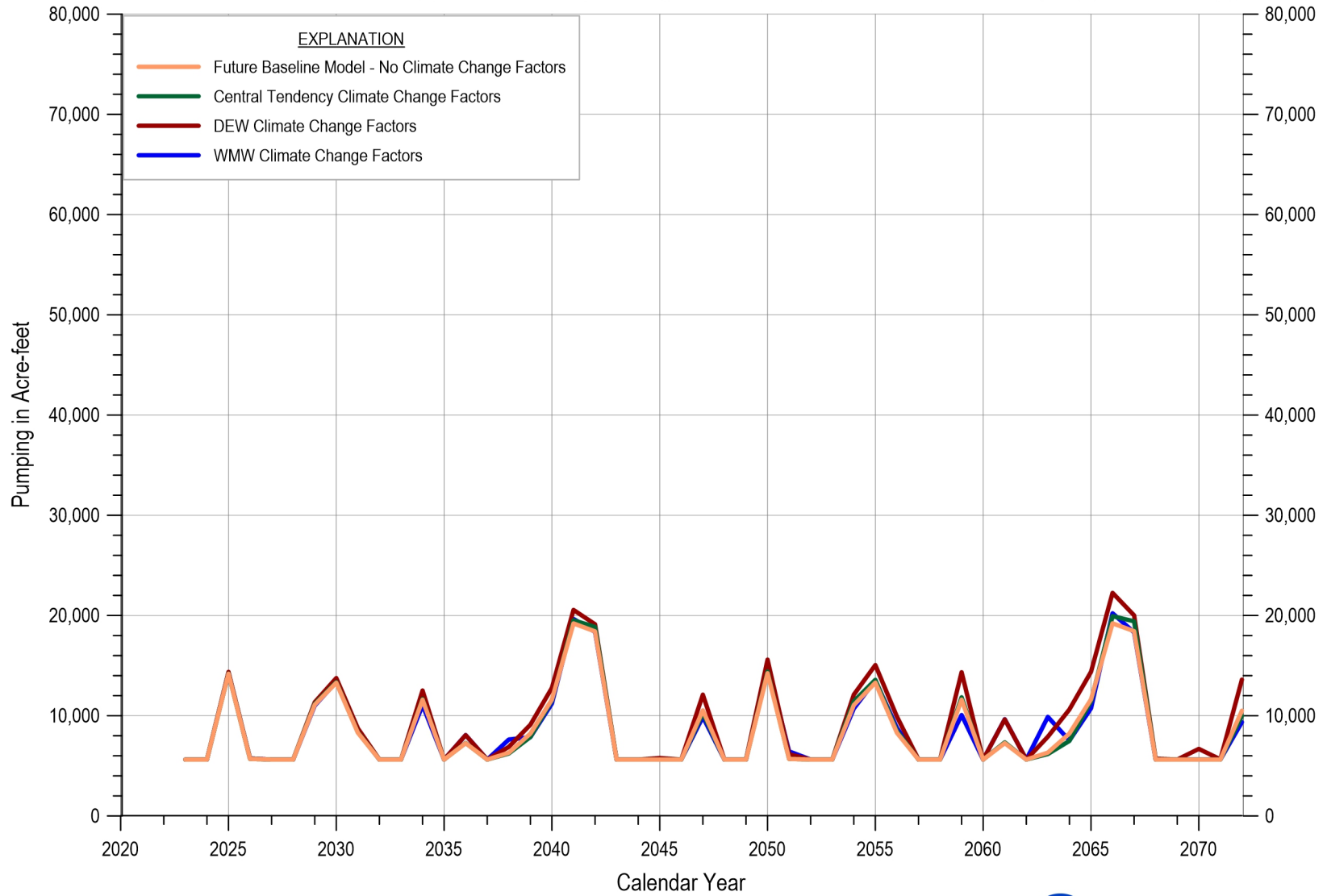


Figure A1: Modelwide Sum of Pumping in Acre-feet in Month 1

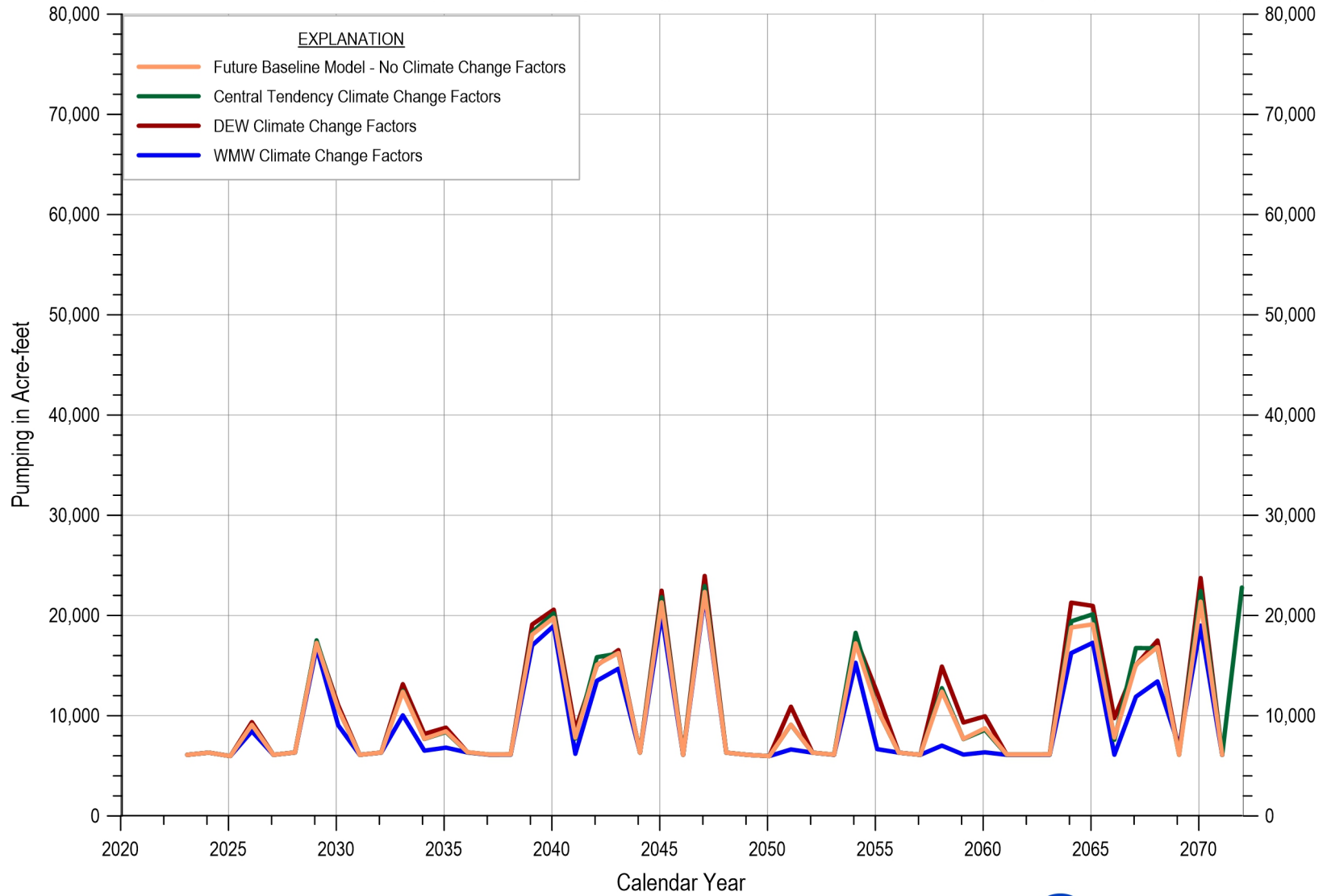


Figure A2: Modelwide Sum of Pumping in Acre-feet in Month 2

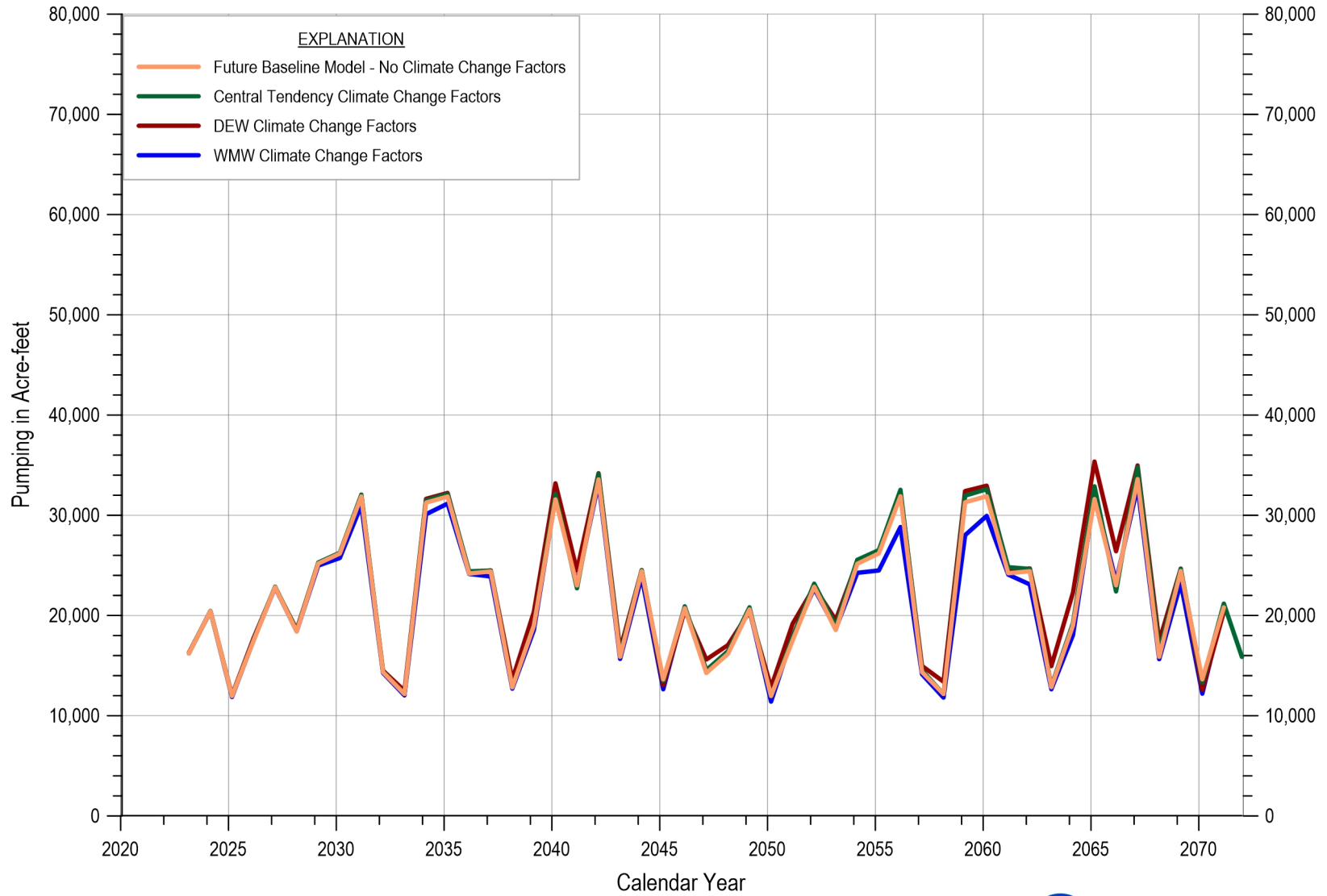


Figure A3: Modelwide Sum of Pumping in Acre-feet in Month 3

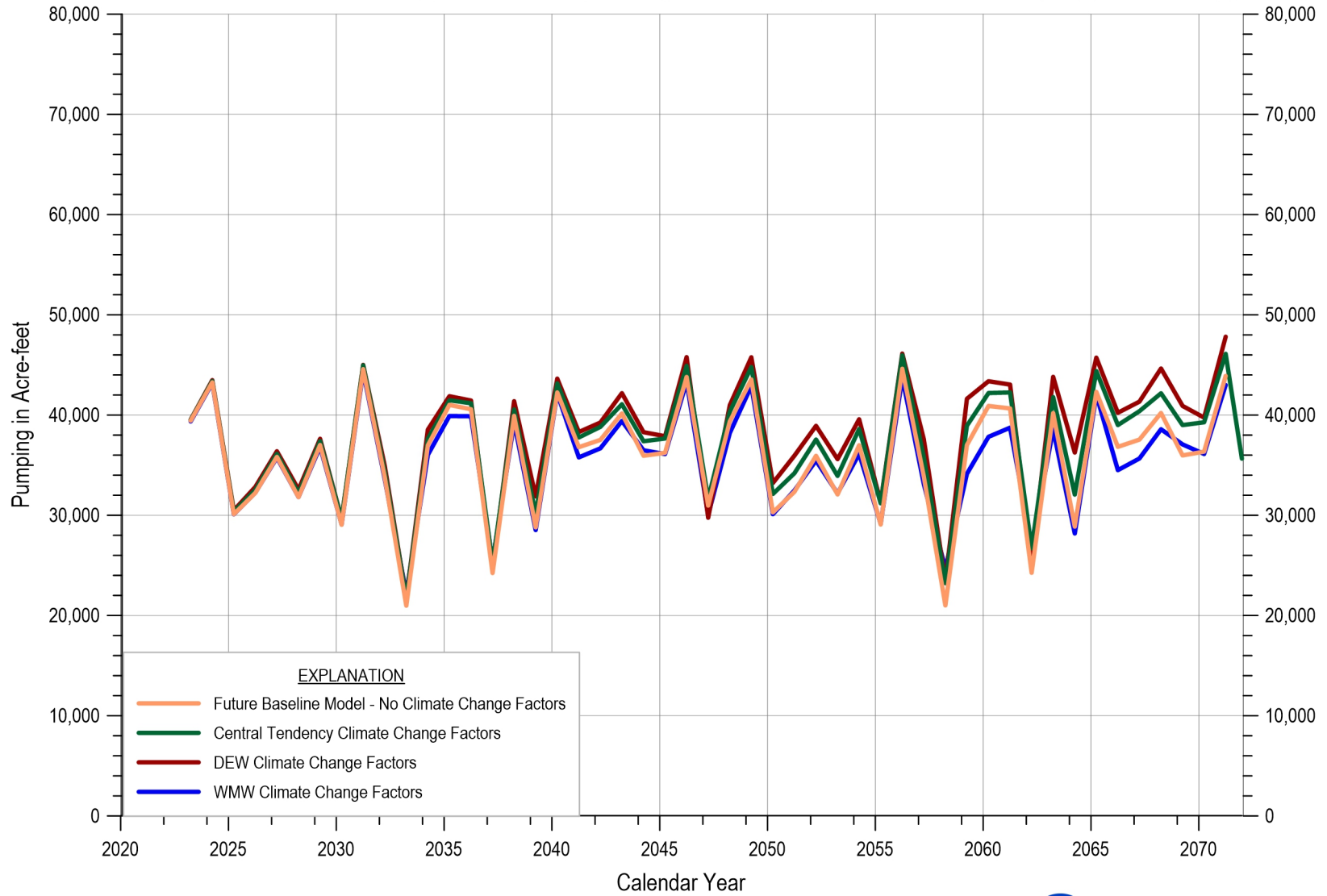


Figure A4: Modelwide Sum of Pumping in Acre-feet in Month 4

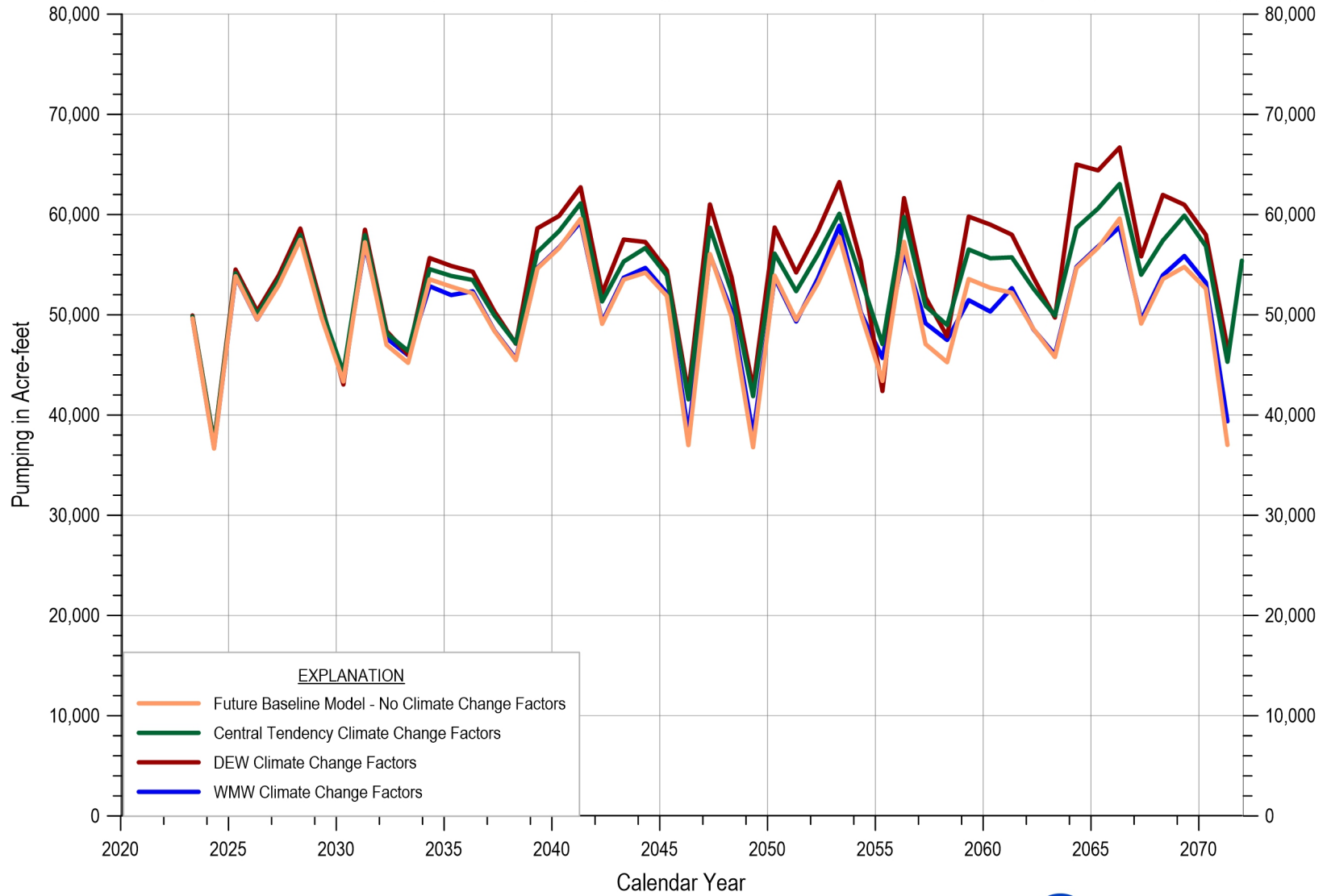


Figure A5: Modelwide Sum of Pumping in Acre-feet in Month 5

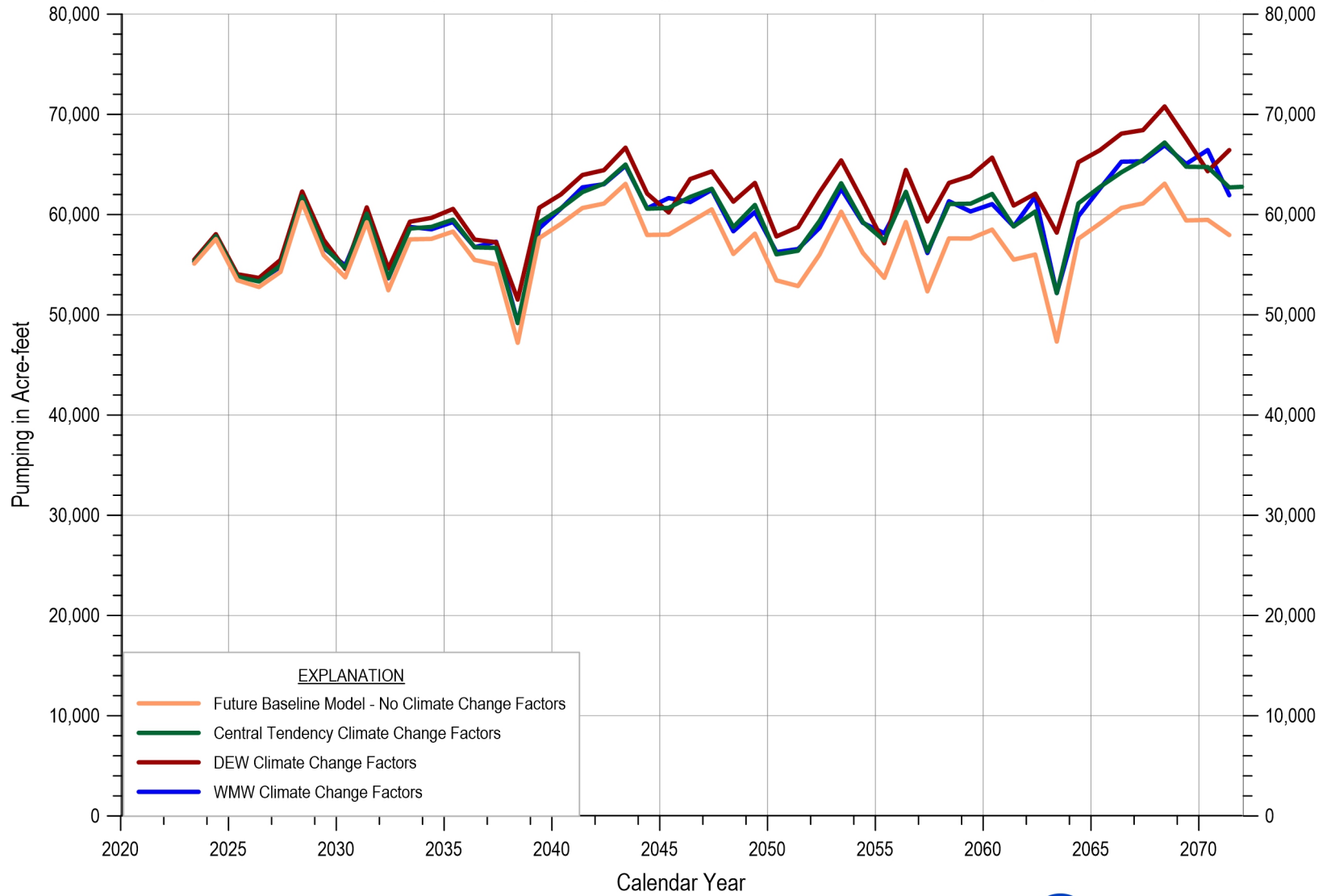


Figure A6: Modelwide Sum of Pumping in Acre-feet in Month 6

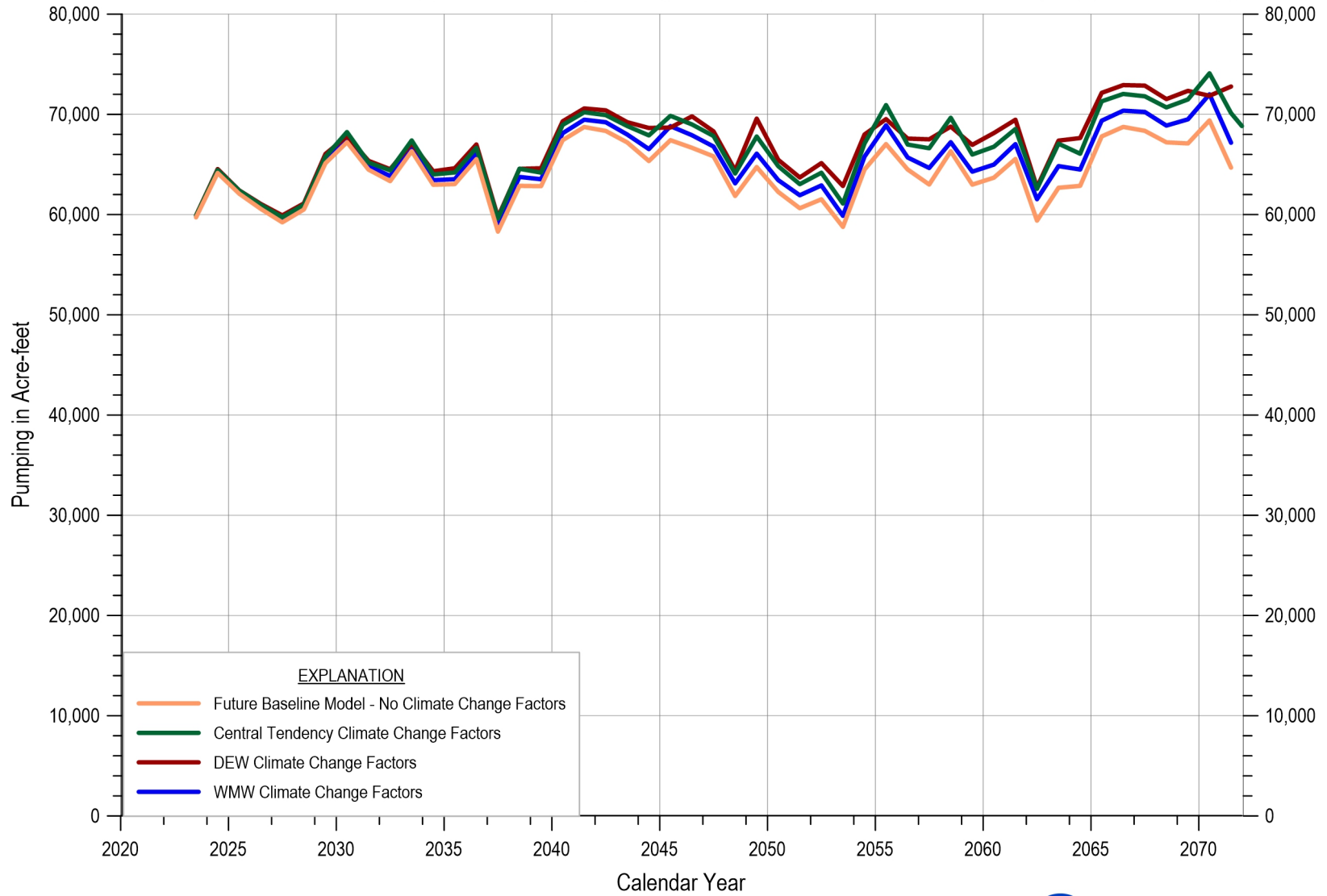


Figure A7: Modelwide Sum of Pumping in Acre-feet in Month 7

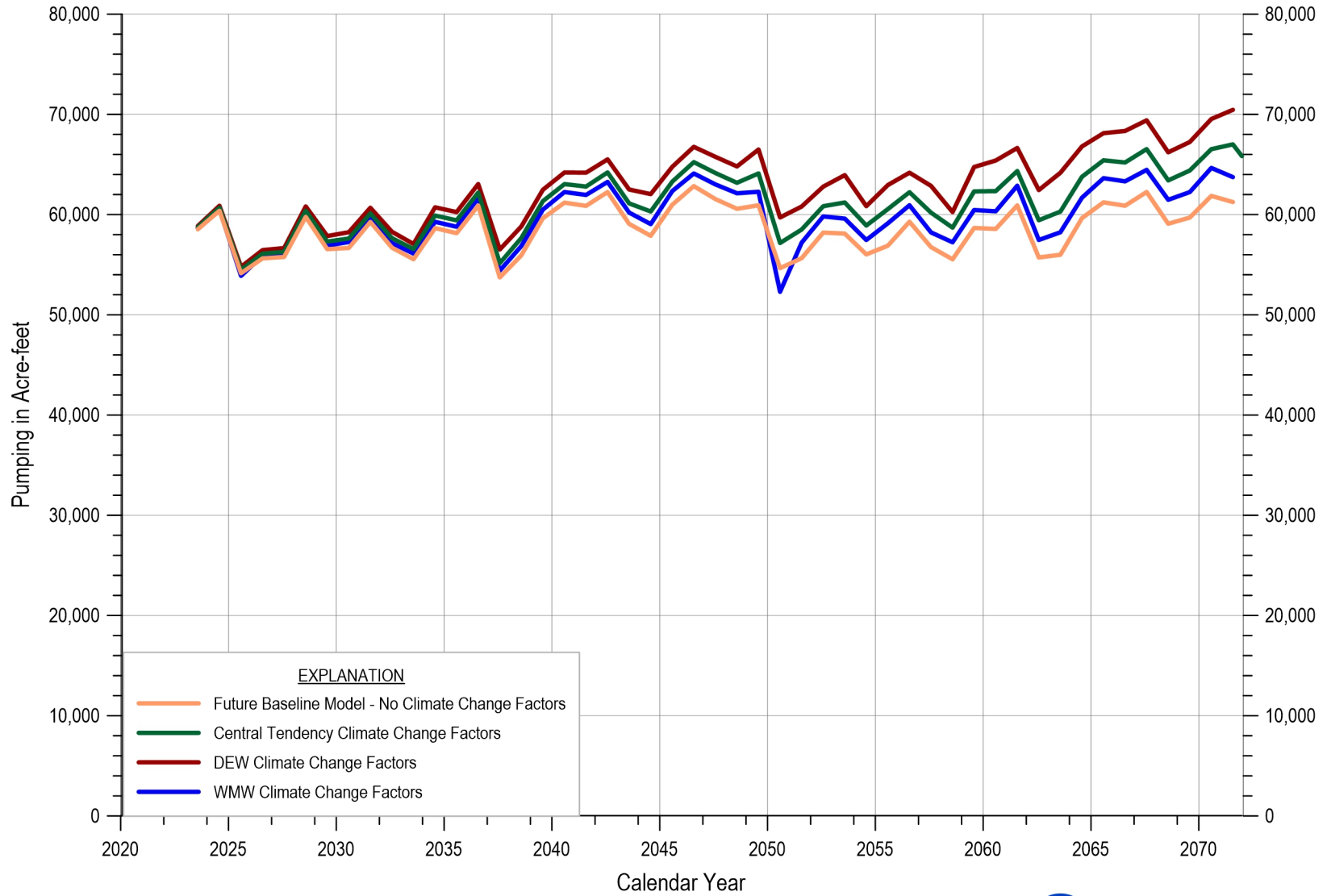


Figure A8: Modelwide Sum of Pumping in Acre-feet in Month 8

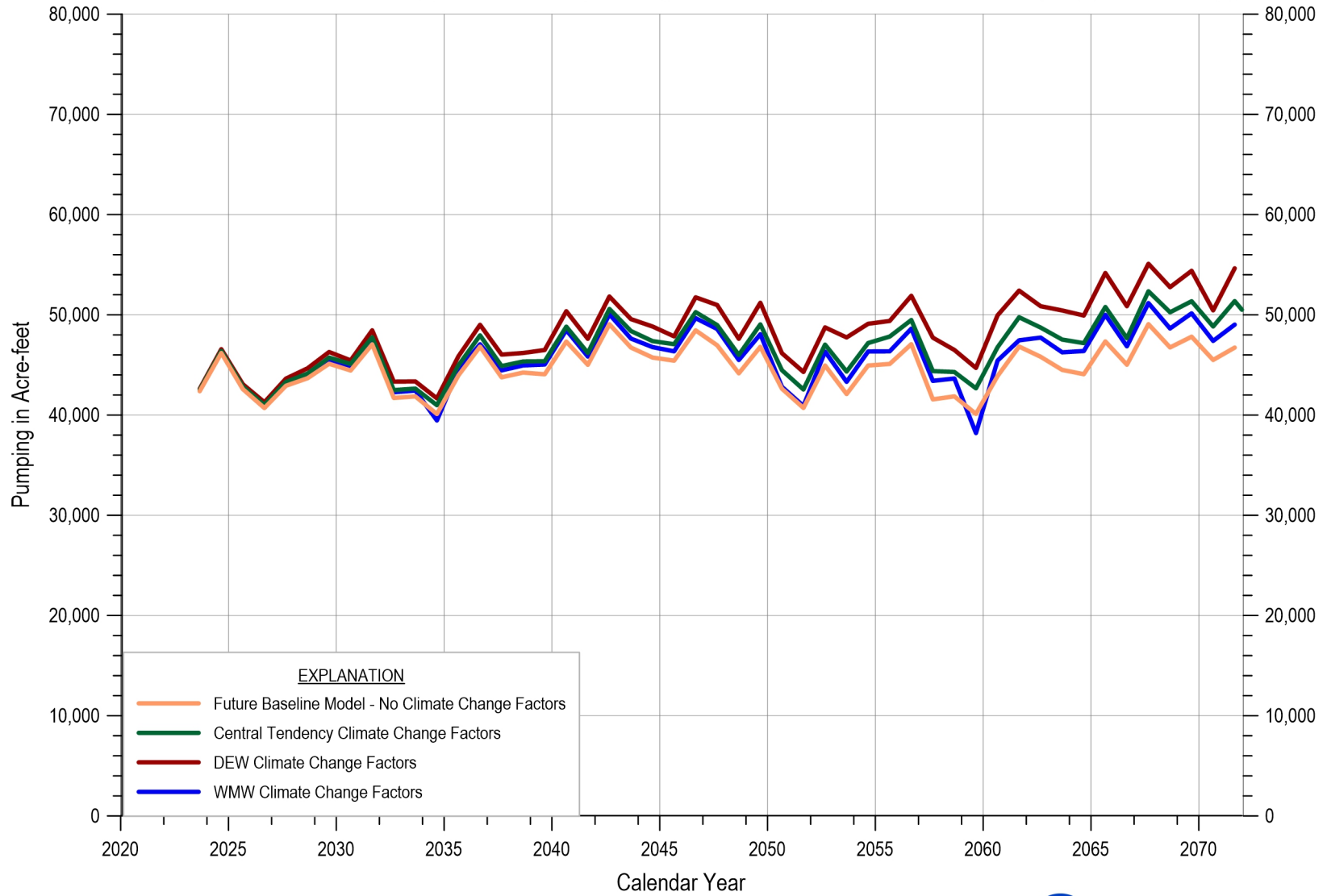


Figure A9: Modelwide Sum of Pumping in Acre-feet in Month 9

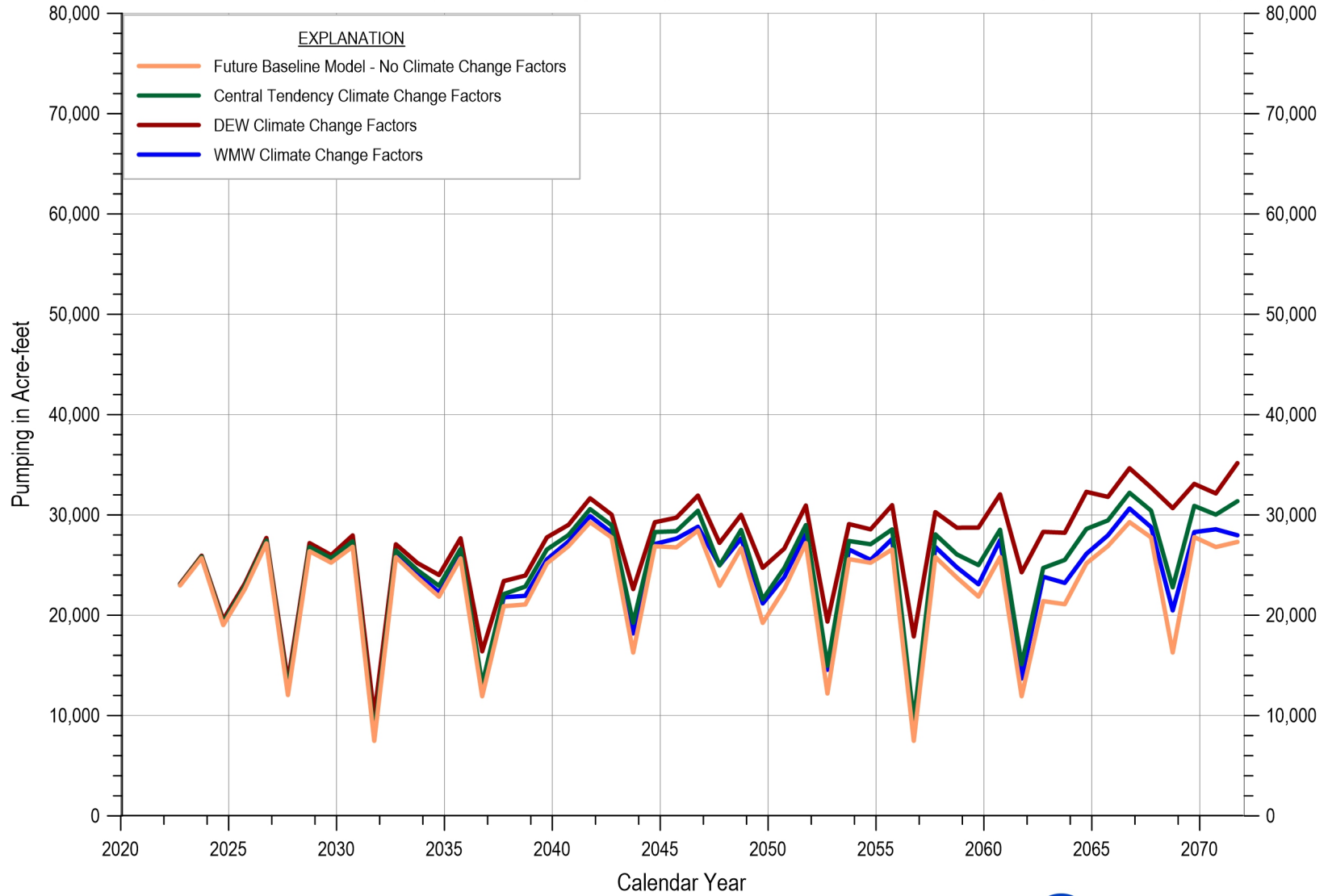


Figure A10: Modelwide Sum of Pumping in Acre-feet in Month 10

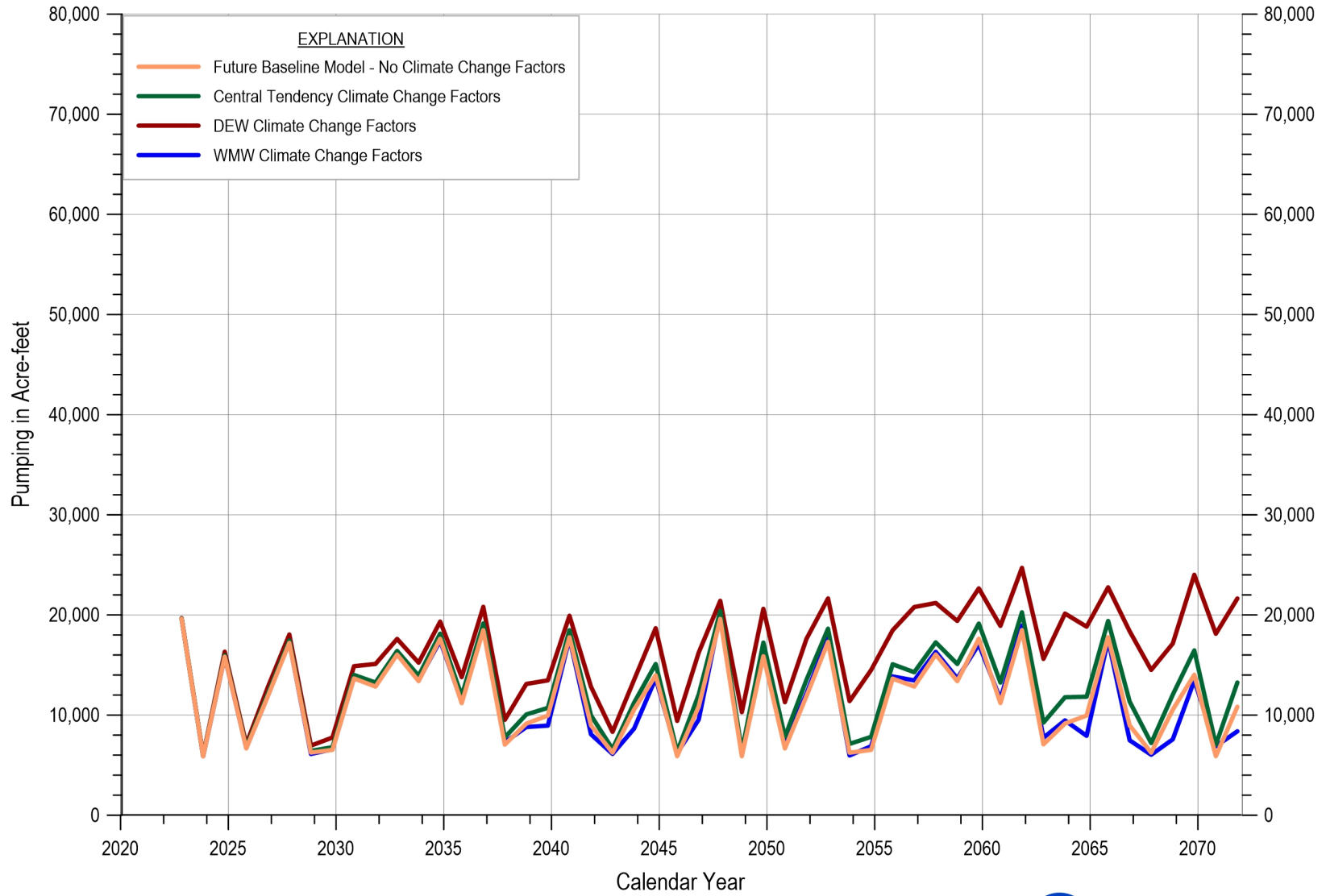


Figure A11: Modelwide Sum of Pumping in Acre-feet in Month 11

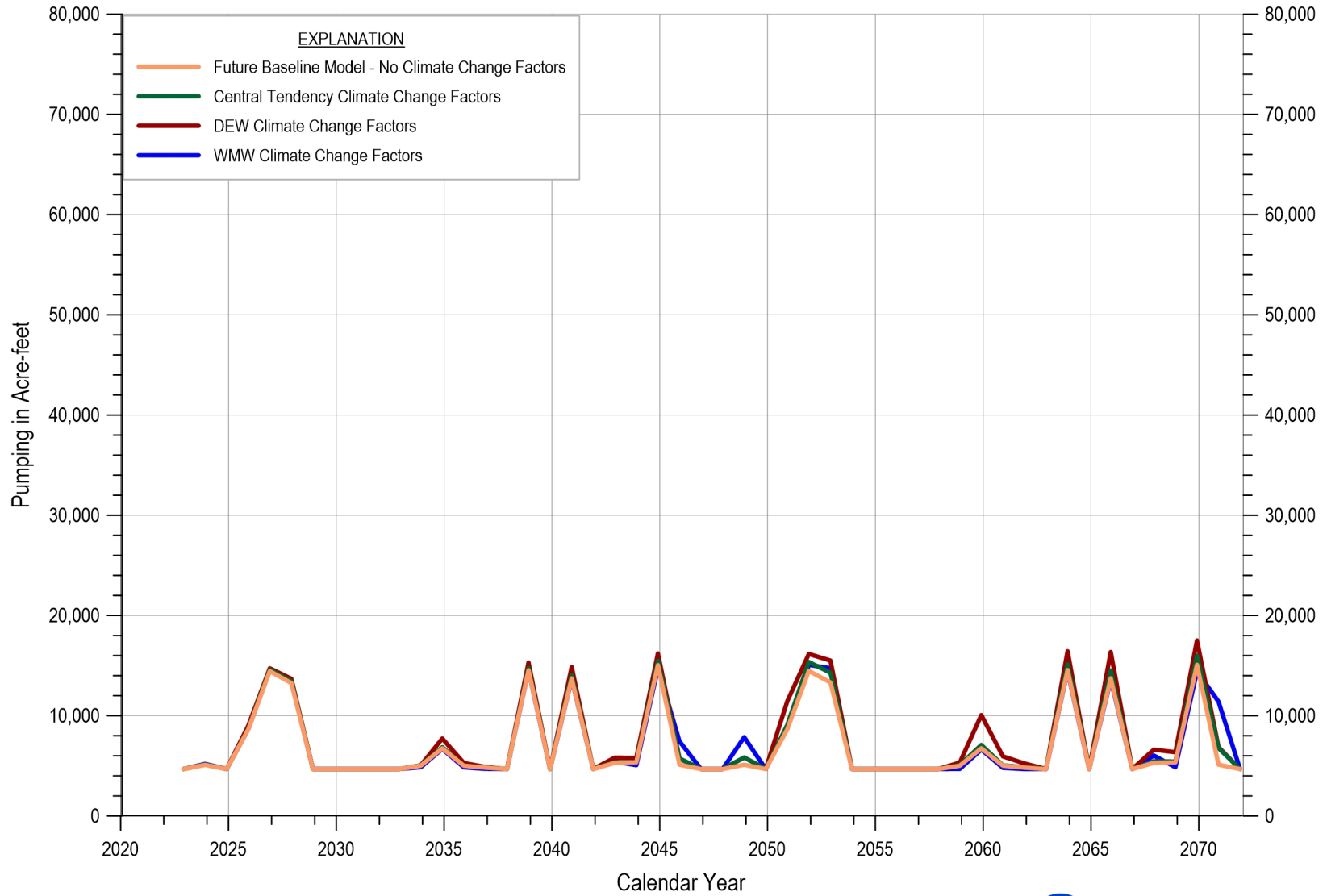


Figure A12: Modelwide Sum of Pumping in Acre-feet in Month 12